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NEW Local Elevators

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U. S. DEPARTMENT OF AGRICULTURE

COSTS - VOLUME RELATIONS IN THE HARD WINTER WHEAT BELT

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U. S. DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

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CONTENTS

Page

The problem 1

Study objective 1

Status of elevator facilities 2
  Need for modernization 2
  Specialized grain region differences 3

Study method 5
  Cases selected for study 5
  Field observations 6
  Other information sources 6
  Cost allocated by functions 6
    Jobs or activities 7
    Budgeting procedure 8
  Models used 9
    Design 9
    Equipment 9
    Office and truck scale 10
    Sideline facilities 11
  Assumptions used for budgeting 11
    Economic environment 12
    Management 12
    Volume limitations 13

Budgeting - how and why by expense items 14
  Fixed expenses 15
    Depreciation 15
    Insurance - buildings and equipment 19
    Personal property taxes 19
    Bonds and licenses 21
    Total fixed costs 22
    Railroad lease 23
  Personnel expenses 23
    Manager's annual salary 24
    Allocation of manager's salary to functions 25
    Bookkeeper's salary 26
    Elevator men's salaries 26
    Extra elevator labor costs 27
    Petroleum tank-truck operator's salaries 28
    Social Security tax 28
    Workmen's compensation insurance 28
    Total and their allocation 29

Page

Slow or sticky expenses 29
  Electric power 30
  Lights 34
  Heat 35
  Water 36
  Telephone and telegraph 36
  Scale testing, adjustment, and repair 38
  Repairs and maintenance 38
  Auditing expense 40
  Advertising 41
  Donations 42
  Meeting and member relations expense 42
  Subscriptions and dues 44
  Legal expense 45
  Directors' fees 45
  Travel 45
  Bad debts 46
  Summary of slow or sticky expenses 46
Other variable expenses 47
  Insurance on stocks 47
  Delivery truck expense 49
  Office supplies 50
  Plant supply expense 51
  Fumigant 51
  Interest on borrowed seasonal capital 52
  Summary of other variable expenses 54
Non-operating statement expenses 55
  Interest on deferred liability and member equity capital 55
  Shrinkage 57
  Quality deterioration 57
Summary of all expenses at a specified volume 58

Expense group response to different volume levels 60
  Fixed expenses 60
  Personnel expenses 60
  Slow or sticky expenses 67
  Other variable expenses 70
  Non-operating statement expenses 70
  Total expenses 73

Analysis by grain functions 76
  Influence of volume on unit costs by elevator sizes 76
    The grain merchandising or handling function 78
    Grain storage function 81

Page

Relative influence of fixed and variable expenses 84
  Fixed expenses 84
  Variable 84
Fixed expenses -- due mostly to plant and equipment 85
  Influence of plant or equipment investment on total expense 85
All variable expenses -- due to volume and management decisions 88
  Influence of size of elevator 88
  Contribution to economy of scale 91
Relative importance of the two expense item groups 94
Other building situations 94
  Influence of old elevator operating in conjunction with the new 97
  Adding expensive equipment -- a dryer 100
  Building and equipment costs increasing or decreasing by 20 percent 102
    Grain merchandising or handling 102
    Storage 105

Influence of the sideline function 105
  Unit costs 105
  Complimentary relations 108
  Supplementary relations 108

Conclusions 109

NEW LOCAL ELEVATORS,
Cost-Volume Relations in the Hard Winter Wheat Belt

By

Thomas E. Hall, Walter K. Davis, and Howard L. Hall [1]

This study shows the influence of plant size, volume, and sidelines on the cost of operating new local elevators in the hard winter Wheat Belt.

THE PROBLEM

Many elevators need to modernize to meet current and prospective grain marketing and storage conditions. Their problem is to make future investments in elevator plant and equipment that will save the most in per bushel costs of grain storage and marketing.

This is a difficult and complex problem. Completely new country elevators represent a large investment. Those recently built in Kansas of concrete cost from $85,000 or $90,000 up to several hundred thousand dollars. Thus, valuation costs are high. To operate at a lower than average level of per bushel costs, elevators must more than offset higher valuation costs with more volume and lower per bushel costs for salaries, insurance, repairs, and other such items.

For maximum economy the new elevators must be in use for most of their expected life of 40 or 50 years rather than become obsolete in a relatively few years. Once built they cannot be moved. Their design and equipment usually cannot be changed substantially except at high cost, unless provision for future change is incorporated in the construction of the plant. Under these circumstances when a cooperative decides to invest in new elevators, new elevator additions, or new elevator equipment, the problem of how big a plant to build, what equipment to install, and what provisions to make for future expansion or change, becomes increasingly important.

STUDY OBJECTIVE

In view of the problem, the objective of this study was to develop more accurate guides and criterion on evaluating costs. Then those in the hard winter Wheat Belt who plan to make future investments in country elevator facilities and equipment can make practical use of the results of the study.

[1] Respectively: Chief, Grain Branch, Farmer Cooperative Service; Agricultural Economist, Grain Branch, Farmer Cooperative Service; and Research Associate, Iowa State College.

Specifically the study sought to measure more exactly the influence of modern designed elevator plant capacity costs of merchandising or handling and storing grain under various volume situations. These cost factors are important at a given prospective building location. From these cost determinations an attempt was made to develop rules-of-thumb or general guides that have practical application.

STATUS OF ELEVATOR FACILITIES

Except for the Southern half of the hard winter Wheat Belt and the Pacific Northwest, most country elevators in operation during the 1953-54 marketing year were at least 30 years old. Such elevators were built for a much longer harvest period, than is now common, for horse and wagon or small truck farm-to-market transportation, and for farm-stored grain. In some cases these elevators were originally equipped with gasoline engines for power.

Now with combine harvesters, better farm-to-market roads, larger trucks and tractors, and electric power, a farmer can move an entire crop directly from the field to the elevator, when harvest weather is good, in a matter of 10 days or 2 weeks. Transportation is no longer a factor in making farm storage a necessity for those farmers living several miles from the elevator. Nor is it a major consideration in spreading elevator grain receipts throughout the marketing year.

Need for Modernization

Elevator modernization as used here means improving elevator and equipment design and increasing handling and storage capacity to meet present farmer needs as contrasted with their needs 30 years or more ago when most elevators were built.

Most farmers in the hard winter Wheat Belt, where wheat is their principal cash crop, now prefer elevator storage rather than farm storage, even when they have usable bins at home, for the grain they expect to market. 2/ Elevator storage is usually cheaper, and more convenient, and it saves farmers the risks of quality deterioration associated with storage at home. This change in farmers' storage practices has created a strong demand for more elevator storage capacity at both local shipping points and terminal elevators.

2/ Hall, T. E., Changing Grain Storage Costs - Farm vs. Elevator, United States Department of Agriculture, Farmer Cooperative Service, Circular 6, April 1954.

Commodity Credit Corporation stocks of hard winter wheat are another factor indirectly responsible for many elevator storage additions and some new elevators. Farmers in the region prefer elevator storage for grain given as collateral for loans. The grain is already in the elevator when C.C.C. takes it over and remains there until moved. When C.C.C. cannot move it to make room for the new crop, the wheat occupies elevator storage capacity that would otherwise be available for farmer-owned grain. Thus, indirectly these C.C.C. stocks create further demand by farmers for more elevator storage capacity.

Shorter harvest season movements, more elevator storage, and larger trucks, create a strong demand for fast receiving capacity at elevators. Compared to 30 years ago this means much faster elevating capacity, larger truck and loading out scales, and more railroad siding. It means wider driveways, larger dump pits, faster truck hoists, fast convenient truck loading facilities, and modern equipment and elevator design for minimizing shrinkage and quality maintenance risks.

Per bushel cost of operation is also important in the increased demand for modernization. As a result of all-weather roads and modern trucks, farmers can haul their grain longer distances. For relatively small differences in elevator service, farmers can now afford to bypass their nearby elevator in favor of one at a few miles greater hauling distance.

Furthermore, elevator operating costs, including salaries and wages, have increased rapidly. Per bushel gross margins have remained relatively constant. The resulting cost-margin squeeze has given added incentive for greater volume and resulting lower per bushel costs. Thus, elevators have found it to their advantage, from a per bushel cost point of view, to modernize their plant and equipment in line with farmers' present marketing and storage needs. Those that could not or did not modernize have a much poorer chance to obtain the volume necessary to make per bushel costs low enough to successfully compete with those who did modernize.

Specialized Grain Region Differences

The intensity of demand for modernization of elevators differs in other specialized grain regions from those just described for the hard winter Wheat Belt. However, the same factors influencing demand for elevator modernization are present in other specialized grain production regions. But the degree of their influence varies substantially from one region to another, and to some extent, for different areas within a given grain region.

Comparisons of the demand for elevator modernization in the Great Plains hard winter wheat region with the need in the Pacific Northwest, the spring wheat region, and the Corn Belt show:

1. The demand for elevator storage for wheat plus the changeover from sack to bulk grain handling has resulted in most of the good-volume local shipping points having new modern elevators of from 100,000 to several hundred thousand bushel capacity in the Pacific Northwest wheat sections.

2. Elevators in the heavy producing sections of the hard winter wheat region are primarily marketing wheat - a one harvest a marketing year proposition. Corn Belt elevators may handle substantial quantities of four grain crops - wheat, oats, corn, and soybeans. Compared to the elevators in the heavy wheat producing regions, elevators in the Corn Belt can spread harvest receipts during the marketing year and thus lessen the pressure for fast handling or receiving capacity in order to handle adequate volume annually.

3. The risk of quality deterioration in farm storage is less in the spring wheat regions because of cooler temperatures during more of the storage year. Therefore, there is much greater use of farm storage and less pressure for elevators to receive a high proportion of the crop during the harvest period.

4. Because of natural drying of ear corn in farm cribs, and the higher proportion of grain production used locally for feed, elevators in the Corn Belt still have considerably less demand to store farmers' cash grain. Their marketing of corn out of crib storage from balances not fed at home also is spread over a larger portion of the marketing year.

Therefore, the present status of elevator facilities and equipment in the principal grain producing regions is closely associated with the intensity of need for modernization. In the Great Plains hard winter Wheat Belt and in the Pacific Northwest, modernization has progressed farther than in any other of the major grain areas. The need is strongest there, particularly in the Southern half of the Great Plains Region and in the Pacific Northwest. Here most country elevators now are new slip form concrete plants with capacities at local shipping points from 100,000 to more than 1 million bushels. Other major grain regions are still using older, smaller elevators. The proportion of such elevators to new ones increases to a point in some of the Corn Belt states that few new elevators have been built.

While the need is less intense in the spring Wheat Belt and in the Corn Belt, it is increasing because of the same factors described for the hard winter wheat regions. Thus, it appears new elevators will be necessary in other areas in a matter of from 5 to 10 more years.

STUDY METHOD

The study analyzed costs developed in models of country elevator operations. The authors developed the models used from intensive observations of cases selected to be representative of model size and type, from analysis of about 250 Kansas elevator operating records and from several years of personal observation of Kansas elevator operations while they were working in the operating field and later as research workers studying other elevator problems. This experience and information was drawn on to achieve as much accuracy as possible when budgeting items of costs to the model operations used.

This method had the advantage of allowing control of the many variations found in actual cost factors influencing elevator costs of merchandising and storing grain. By this control the influence on operating costs of factors not being studied could be eliminated. Thus the influence of factors studied could be determined more exactly.

Annual country elevator costs available from audit statements and records of operations maintained by these companies are practically never entirely comparable for several reasons. They vary for any given marketing year because of size of facility and equipment. The same size elevator may have different costs because of management practices, sideline operations, volume of grain handled and stored, and valuations on plant and equipment. Elevator operating costs also may vary because of rates that may be peculiar to a specific location for such items as insurance, labor, and power. Therefore, an analysis of country elevator operating results, as given in audits of elevator expenses, is not very accurate in determining the specific influence of size of plant and equipment under various volume situations, even with a large sample. Thus, the authors believe the method used is much more accurate for this study.

Cases Selected for Study

Cases selected for field observations gave the information which was not available from other sources but which was necessary to budget expense items to the study models on a practical and accurate basis. Kansas elevators, located in the Plains section of the State, were used. Two elevators were selected from each of the following capacity groups: 20,000-bushels or less, 100,000-bushels, 200,000-bushels, 300,000-bushels, and above 500,000-bushels. From each capacity group a selection was made of one elevator with relatively low sideline business volume and one with relatively large sideline volume.

Each of the elevators selected for intensive study was picked from a similar group of from 10 to 20 elevators, for which recent audit reports were available. Those selected were representative of the size grain plant and sideline operation set up as a study model. It was not possible in every case to get the exact sideline operation desired, particularly in the large sideline group. In the larger elevators used, sideline operations usually included, in addition to feed and petroleum, such services as feed grinding and mixing, a lumber yard, or a hardware store. With this exception, however, the elevators studied were typical of those used in the models analyzed in this report.

Field Observations

From the foregoing selection, observations of 2 to 3 days duration were made at each plant during 4 different seasons -- during the harvest movement of 1951, the fall of 1951, the winter of 1951, or early spring of 1952, and the late spring season of 1952. Personal observations were made at the plants under study to assist in the accurate distribution of cost for labor and management and other items on a functional basis under different volume situations. Data were also collected on experience with shrinkage and quality deterioration. The companies' ledger accounts were examined to obtain an exact description and knowledge of expense items making up accounts in the annual statement of operations, such as office supplies, insurance, miscellaneous and others. The ledger account or audit statement names of these expense accounts were not descriptive of the actual expenditure. Data were also collected on power consumption per unit of volume handled.

Other Information Sources

Another source of information used in the budgeting procedure was a previous statewide survey of all Kansas farmers' elevator companies - about 250. Kansas State College, Manhattan, Kansas, and the Cooperative Research and Service Division of the Farm Credit Administration made this survey in 1951. It afforded additional information on typical rates and amounts of expense for various size plants and volumes.

Cost Allocated by Functions

In this study allocations of all elevator association costs are made to three major operating functions - grain merchandising or handling, grain storage, and sideline operations. Grain merchandising or handling constituted the primary function. The other two were considered as secondary.

Practically all country elevators were organized, incorporated and operated in their early years almost exclusively for the grain merchandising or handling function.

Other operations - the so-called sideline and the storage function - were taken on as important secondary functions. While these two functions are secondary to grain merchandising or handling they are also both complementary and supplementary to the primary function. They are supplementary to the extent they help utilize idle time inherent for regular full-time employees needed for the primary function, and they provide more efficiency in the use of such primary expense items as power, member, and public relations costs, and similar items. Under present operating conditions, and particularly for the storage function, these secondary functions are also complementary - that is, they contribute to more volume of grain merchandised or handled. Country elevator managements' decision to add these secondary functions has been motivated to a large extent by the additional volume for grain merchandising or handling and by the supplementary aspects previously mentioned.

On the fringe of the heavy cash winter wheat areas, at a few elevator locations where the grain production has decreased substantially, or where the elevator territory is small, the sideline function has increased over the years to a point where it is more important than grain merchandising or handling as measured by dollar volume, time of personnel, or investment in facilities. But this is the exception rather than the rule and is very seldom the situation in areas where winter wheat is the principal cash crop.

The storage function may represent a larger investment of capital than the primary function of grain merchandising or handling. But grain is stored for sale or use and therefore storage remains secondary to the functions of its merchandising or handling.

Jobs or Activities

Of course, a clear-cut segregation of all jobs and operations into these three major functions was essential. The segregation made and used for the three major functions was as follows:

1. The primary function, grain merchandising or handling, included all jobs and operations associated with grain purchases and sales and the in and out handling on a fee basis of C.C.C. or other grain. It includes weighing, grading, dumping in the elevator, elevating, rebinning for merchandising purposes, cleaning to improve sale grade, ordering and coopering cars, loading cars or trucks, and making out bills of lading. It included all bookkeeping and accounting and public and membership relations activities not specifically due to the other two functions. Furthermore, it included these jobs and operations on grain received for storage since such grain was later practically always merchandised or handled in the same manner, in the winter wheat area, as grain receipts purchased.

2. The grain storage function included the job of bookkeeping and accounting in addition to that necessary for the merchandising or handling function. It included turning, cleaning or fumigating storage stocks to maintain quality during the storage period.

3. The sideline function in the models included purchase and sale of feeds, seeds, fence posts, salt, and a few miscellaneous farm supplies that could be conveniently handled in the feed warehouse. Annual volume of these items was $30,000. These were the sideline commodities handled in the example of low-sideline volume. For the larger sideline volume, petroleum products were added, including bulk delivery of gasoline and tractor fuel oil. A section of the feed warehouse was used for stocking oils and grease in small containers. All bulk petroleum products were handled through regular bulk plant facilities, from which two tank wagon trucks make regular farm deliveries. This added $115,000 annual volume making a total of $145,000 volume for the larger sideline operations used in the models.

Budgeting Procedure

The allocation of all elevator association expense was made on the following premise: All association expense was charged to the primary function (grain merchandising or handling), except that which was a direct expense of a secondary function or an extra expense above that which would logically occur if operations were confined to the primary function.

In the case of extra expenses the authors developed the procedure used to allocate the expense item to the primary and to one or both of the secondary functions. They kept in mind the study objective of practical guides for management decisions. Field observations and counsel from operators and auditors in the area studied, as well as the basic characteristics of the country grain elevators' major functions in the Wheat Belt, influenced their judgment in making the allocations.

Direct expenses were easy to allocate. Examples were: Cost of sales tickets for sidelines, advertising feed, insurance on the feed warehouse and stocks. Examination of the posting description of individual expense items in the various ledger expense accounts gave an accurate account of what the expense was for and helped increase the percentage of all expense that could be allocated as a direct rather than as an excess expense to its proper function.

Expense items incurred for two or all three functions were most difficult to allocate. The two largest items were: (1) salary and labor expense of employees working on two or more functions and (2) fixed expenses on the elevator plant and equipment. The report will later show the exact procedure used in making these allocations.

Models Used

The models used were the design and equipment specifications of most of the recently built elevators. Basically they were similar to hundreds of elevators built in the hard winter Wheat Belt since World War II. Because so many have been built, contractors consider as standard the model specifications used. They make only minor variations in design and equipment to meet personal preferences of individual owners. 3/

Design

Each of 5 different size elevators - from the 20,000-bushel to the 600,000-bushel capacity - was the drive through type. That is, each had the driveway receiving pit and truck lift all within the main walls of the elevator. All had bins over the driveway from which trucks could be loaded by gravity simply by opening a slide valve. It was not necessary to use the elevating equipment when loading trucks from stocks held in such overhead bins. This type facility provided for complete gravity flow of all grain in the elevator of up to 300,000-bushel capacity. Horizontal conveyers in new elevators up to that capacity are not usually necessary.

This is by far the most prevalent basic plant arrangement for new elevators up to 300,000-bushel capacity in the hard winter Wheat Belt. Of course each building project is the result of careful consideration of elevator design by the construction engineer and the practical operator. Now that so many of these elevators are in use, and minor changes have been incorporated from operating experience, the designs shown are those which have evolved from that experience and are now basic ones recommended by nearly all construction firms and accepted by most operators in areas where hard winter wheat is the principal cash grain crop.

Equipment

As basic elevator design for new elevators has become standardized, so has the equipment. Each of the Figures 1 to 4 shows a list of equipment considered standard. Of course, individual plants may vary from the standard. Capacity of the leg may be slightly different, or the operator may prefer two legs where the figure shows one as standard equipment. The operator may want a larger capacity loading out scale than that shown or he may want some special equipment such as a cleaner, equipment for determining grain temperatures in bins, or similar items. The figures shown as standard equipment have much the same position as standard equipment in a particular make of automobile. Often the buyer chooses some extras. In the case of elevators he may choose to have more or faster handling equipment installed.

3/ The concrete elevator design and equipment specifications were furnished by Chalmers and Borton, Contractors, Hutchinson, Kansas. Other contractors building in the region provide similar basic plans and specifications.

When standard equipment is used contractors usually recommend provisions in the plans and specifications for the addition of another leg, other equipment or for more storage capacity. Such a recommendation is certainly good. The additional cost of providing at the time of original construction for expansion of equipment or plant is small compared to the cost of making such additions without having made provisions for them.

The 20,000-bushel capacity elevator design illustrated in Figure 1 for the wood cribbed iron-clad elevators is basically the same as that used in elevators as much as 25 years old. For purposes of simplifying the models used, both the old 20,000-bushel and the new 20,000-bushel elevators are of the same size and design, Of course, in the case of the old 20,000-bushel elevator new faster legs, loading out scales and truck lift have been added in recent years.

The largest concrete elevator model - 600,000-bushel capacity - is the 200,000-bushel elevator illustrated in Figure 3 now being used as a headhouse with a 400,000-bushel storage addition built on one side. This, also, is the usual type of construction for the new very large country elevator facilities.

The following additional equipment to that shown in Figure 3 has been added: (one 6,500-bushel leg and 40-h.p. motor; 30 inch top belt conveyor with 15-h.p. motor; 30 inch bottom belt conveyor with 10-h.p. motor; 30 inch belt tripper; and draw-off spouts with R & P valves. The storage addition is based on 16 tanks 18 feet in diameter and high enough to provide the 400,000-bushel capacity.

Office and Truck Scale

The office was a one-story 14 by 26 foot building. It had two rooms - one 10 by 14 feet, which housed the scale and grading equipment, and the other 16 by 14 feet, which housed the manager's and bookkeeper's desks and the bookkeeping and accounting equipment. It had concrete floors and was of concrete block construction built in 1940 at a cost of $2,000.

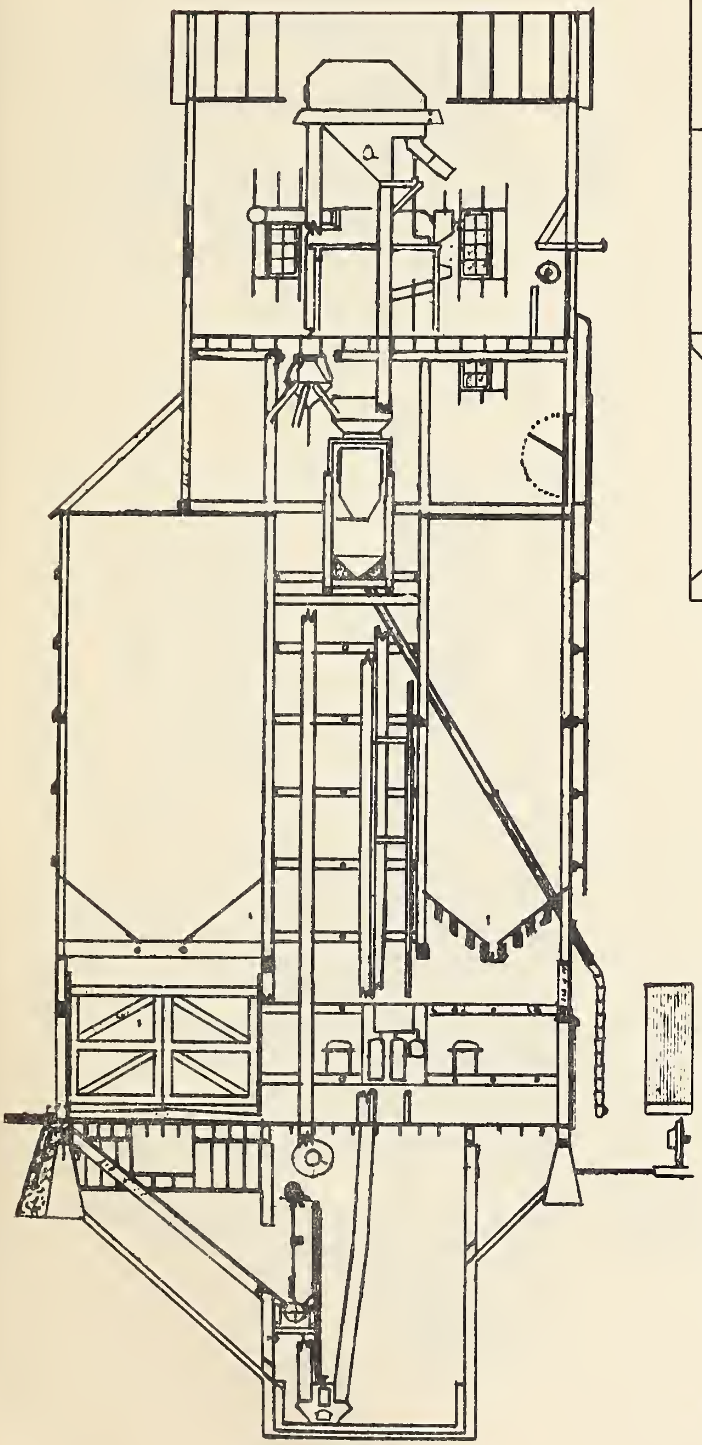
Office equipment consisted of two desks at least 20 years old, 3 steel file cabinets, a safe as old as the desks, an adding machine, a typewriter, an oil burning heater and 2 electric fans.

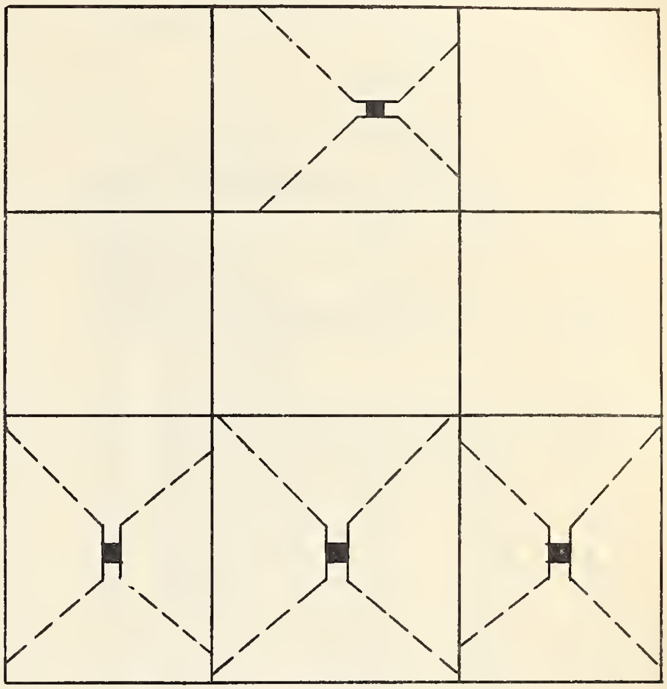
This office equipment, which has not been depreciated out, carries a cost value on the books of $1,000. Grain grading equipment consists of a modern moisture tester, a quart-size bucket and beam, a car hand probe for determining test weight per bushel, and a set of hand screens for determining dockage.

The truck scale was installed in 1950. It has a concrete platform 16 by 40 feet with a type registering beam. Its cost, installed, was $4,000.

Figure 1

TYPE OF NEW ELEVATOR DESIGN AND EQUIPMENT INSTALLATION USED
IN THE 20,000 BUSHEL ELEVATOR MODEL





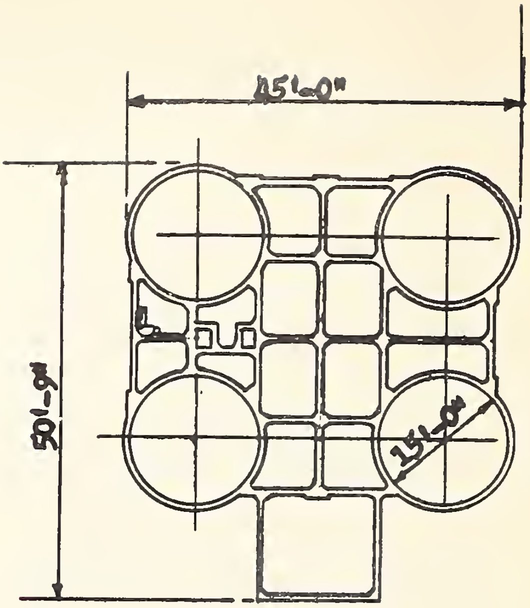
BIN PLAN

CAPACITY

20,000 BUSHELS

STANDARD EQUIPMENT

3,000 bu. leg with 10 hp. motor
9 inch distributor with all steel spouting
10 bu. automatic scale
Steel gate on bins
Steel grate over dump pit
3 H. P. O. H. Trucklift



BIN PLAN

CAPACITY

2	BINS	15,100 BU.	EA.
2	BINS	14.250 BU.	EA.
2	BINS	5,700 BU.	EA.
2	Bins	3,600 BU.	EAL
2	BINS	3,550 BU.	EA.
2	BINS	3,300 BU.	EA.
2	BINS	2,000 BU.	EA.
1	BIN	3,400 BU.	
1	BIN	2,700 BU.	
GRAND TOTAL:		101,200 BUSHELS	

STANDARD EQUIPMENT

All steel leg casing and spouting.
All over head bin valves with R&P.
Two steel curtain driveway doors.
Two dump pits with grates.
7½ H.P. O.H. Trucklift.
All steel 3070 doors.
L.O.S. Well Casing.
10-Bu. automatic scale.
5,000 bushel leg.

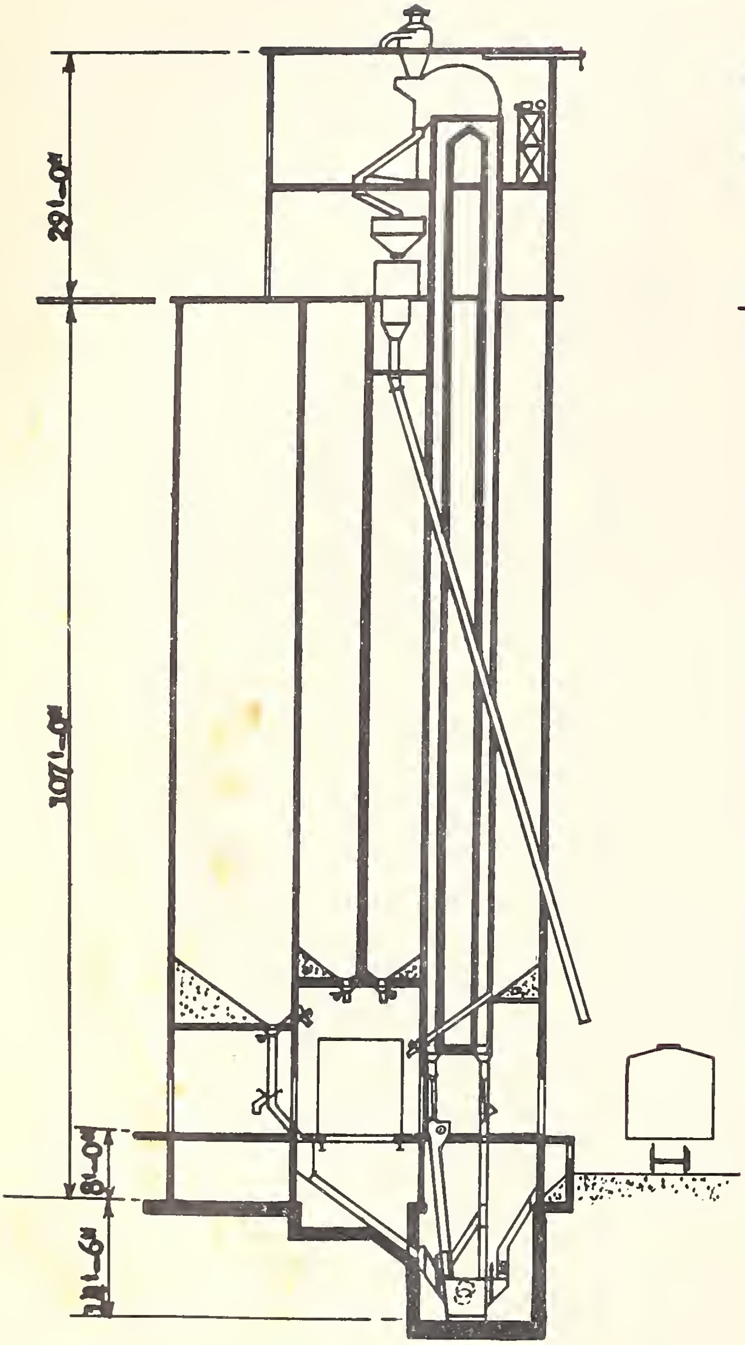


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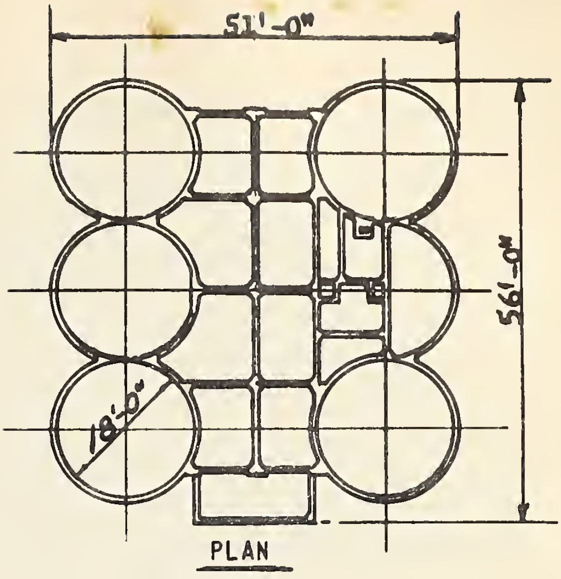
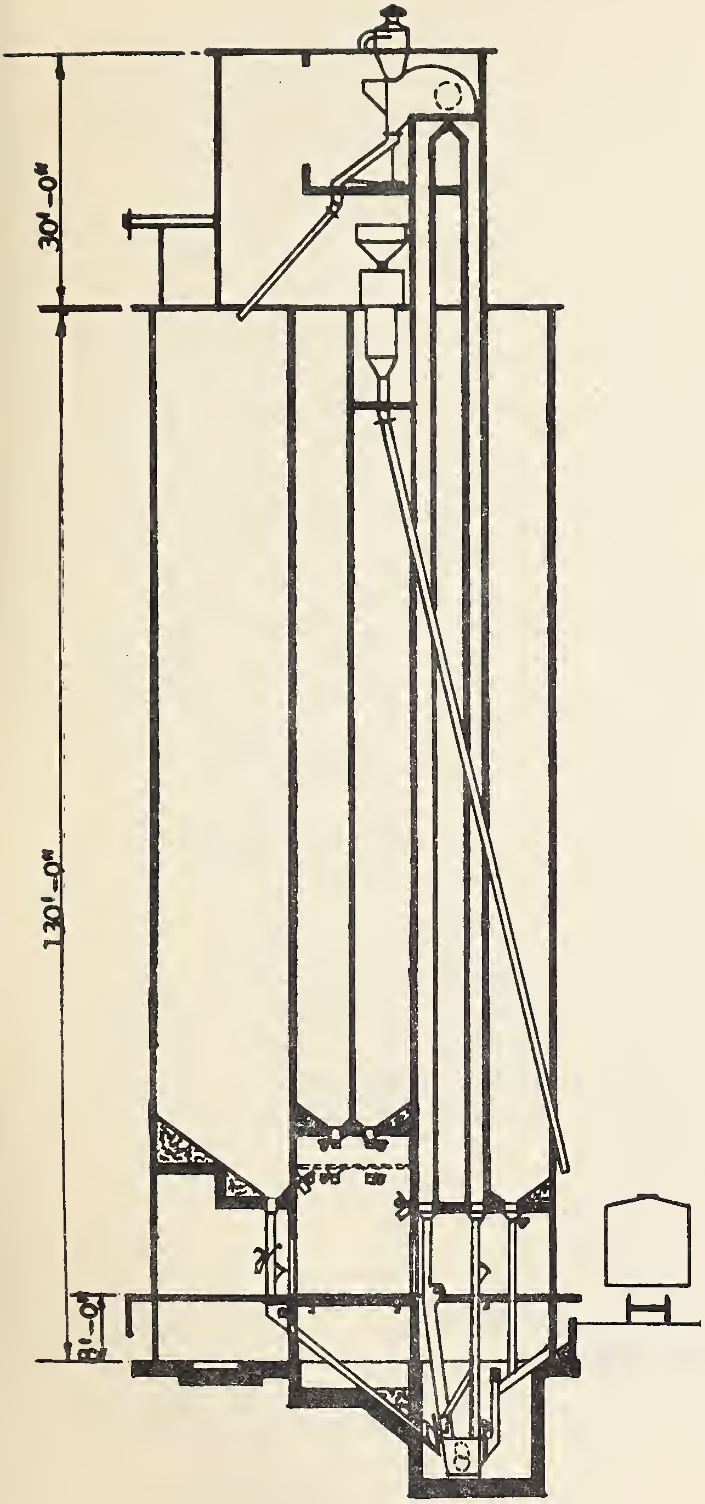
Figure 2
TYPE OF NEW ELEVATOR DESIGN AND EQUIPMENT INSTALLATION USED IN THE 100,000 BUSHEL STUDY EXAMPLE





CAPACITY

2	BINS	25,654	BU. EA.
2	BINS	24,941	BU. EA.
1	BIN	20,564	BU.
1	BIN	10,957	BU.
1	BIN	8,303	BU.
1	BIN	7,977	BU.
1	BIN	6,272	BU.
1	BIN	5,824	BU.
1	BIN	5,660	BU.
1	BIN	5,570	BU.
1	BIN	5,434	BU.
1	BIN	5,347	BU.
1	BIN	3,381	BU.
1	BIN	2,536	BU.
1	BIN	2,301	BU.
1	BIN	1,840	BU.

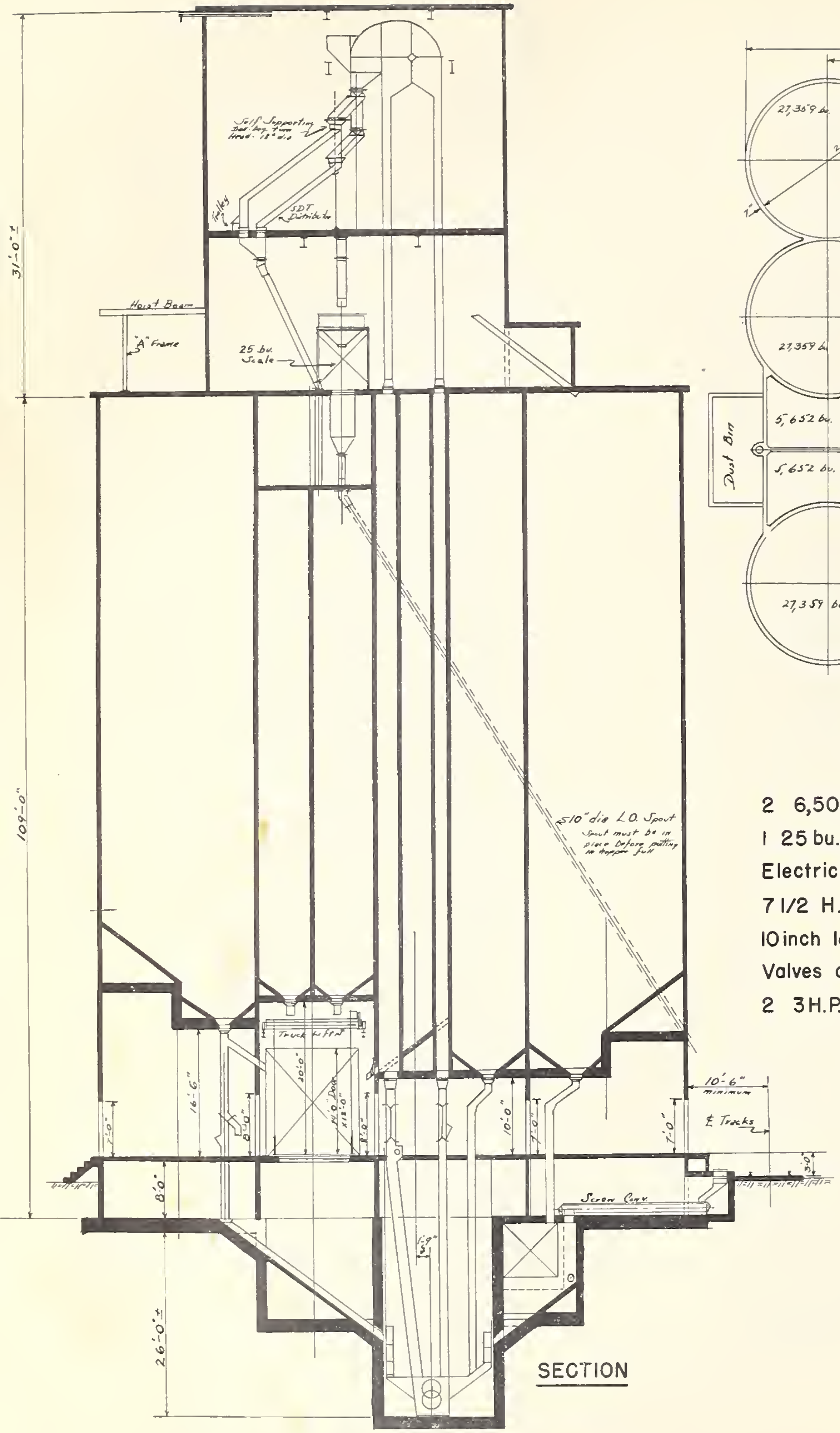
GRAND TOTAL 200,076 BUSHELS

STANDARD EQUIPMENT

All steel leg casing and spouting.
All over head bin valves with R & P.
Two steel curtain driveway doors.
Two dump pits with grates.
7½ H.P. O.H. Trucklift.
All steel 3070 doors.
L.O.S. Well Casing.
Electric Manlift.
15-Bu. automatic scale.
6500 bushel leg.

Figure 3

TYPE OF NEW ELEVATOR DESIGN AND EQUIPMENT INSTALLATION USED IN THE 200,000 BUSHEL STUDY EXAMPLE



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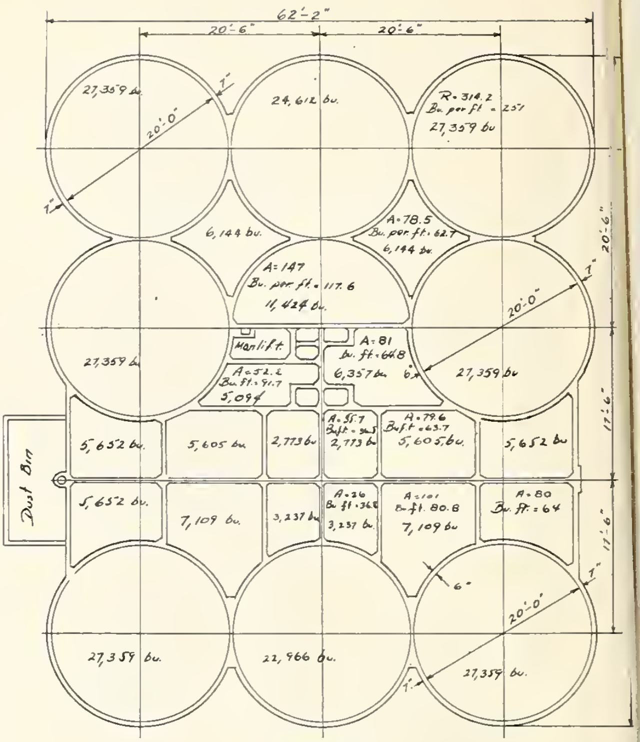

BIN PLAN

STANDARD EQUIPMENT

2 6,500 bu. legs, each with a 40 H.P. motor.
1 25 bu. automatic scale.
Electric Manlift.
7 1/2 H.P. Trucklift.
10 inch loading out spout.
Valves and Spouting.
2 3H.P. suction fans at head.

Figure 4
TYPE OF NEW ELEVATOR DESIGN AND EQUIPMENT INSTALLATION USED IN THE 300,000 BUSHEL STUDY EXAMPLE

The foregoing office, scale, and equipment is reasonably typical of the grain office setup 10 to 15 years old. It is used in all models of elevator sizes in order to simplify the problem calculations. Actually, it is more representative of the elevator sizes of 100,000-bushels or less. The larger elevators will often, though not always, have more invested in truck scales and office building and equipment.

Sideline Facilities

The same size and type feed and miscellaneous farm-supply warehouse was used in each of the models. It was a concrete block, one-story building 16 by 40 feet. It had a hardwood floor and truck loading dock. Its cost in 1940, when it was built, was $4,000. This was the only facility used for sideline operations in the models when annual volume was $30,000.

In the other models, annual sideline, volume was $145,000, The warehouse was the same and was used in the same way. But, in the large sideline volume models bulk petroleum products were added with annual volume of $115,000. All facilities and equipment for handling bulk petroleum products were considered to have been purchased and installed during the 1950 year. Four bulk tanks each of 10,000-gallon capacity, together with necessary equipment and fittings for filling and emptying, were carried on the books at $8,000 cost. Two 1-1/2-ton truck chassis equipped with two 800-gallon four-compartment tanks and power take-off unloading pump and meter also cost $8,000 in 1950. Altogether the bulk petroleum products facilities and delivery equipment cost $16,000 which, added to the building cost of $4,000, made a total of $20,000 cost for facilities used in the models with $145,000 annual sideline volume.

The sideline activities and facilities were more typical of those used by the medium-size elevator. The two larger elevators used in the models will often have in actual operations, a wider range of sideline services, more volume, and more investment in facilities and equipment. However, for the purpose of this study the two sideline models were made comparable for each size elevator facility.

Assumptions Used for Budgeting

It was necessary to control the influence of economic environment, management, and practical volume limitations for the different models used in this study. Assumptions for these factors had to be made so that the different model operations would be comparable. Thus, the influence of these factors was controlled in order that they might not have an unknown affect on cost factors under study. The assumptions made for this study follow:

Economic Environment

The general economic environment used in connection with the study on budgeting procedure was the same as that prevailing in the western two-thirds of Kansas during the 1951 and 1952 calendar years. These years showed a relatively high level of prices and costs. Employment was at a high level though not as high as during World War II. Therefore, management had more flexibility in employing personnel than during the war period but much less than during times of recession or depression.

Under a comparable situation management can usually depend on getting reasonably competent part-time office help and extra labor at the elevator to meet peak seasonal labor requirements. Management's situation also allows for small adjustments in salary for different levels of annual volume. On the other hand once management has found good help, competition for labor is sufficient to make it necessary to pay competitive salaries and wages and to keep key employees on an annual basis even though there are seasons when the elevator man or the bookkeeper has considerable idle time.

Building costs during the 1951-52 period were a little lower than during World War II but high in relation to prewar costs, reflecting higher cost levels on materials, labor and equipment. However, there was not the scarcity and relatively noncompetitive situation that existed during the years of World War II.

Management

The level of management assumed in the models used in this study was good. No attempt was made to stimulate the very best management but management was assumed to be above average for each of the five different size facilities illustrated. Good, but not superior, management describes what the examples attempt to simulate.

Good management as used in this study means management which has been able to achieve the following results: Less than average grain shrinkage, no quality deterioration that will affect costs; above average utilization of personnel, and a little above average record for getting the most return from necessary variable expenses.

Salary scales for managers were determined from careful study of the Kansas cooperative elevator survey mentioned on page 24, from field observations, and from consultation with cooperative auditors and regional cooperative grain fieldmen, all of whom had opportunity to be familiar with salaries of country elevator managers for various size elevator plants and operations.

Volume Limitations

In order to study the influence of size of elevator and grain equipment under different grain volumes, sideline volume was held constant for each size elevator at both $30,000 and $145,000 annually. Costs were calculated for each elevator model and their various grain volumes for both sideline situations.

With respect to grain volume there were two major considerations important for an understanding of this study and its analytical procedure. They were: (1) The practical maximum limitations on volume that can be merchandised or handled through any given size elevator, and (2) the different levels of volume used in the models, were presumed to be those that local management would count on as average at their building location. The budgeted volume levels are not intended to illustrate year to year variations in costs due to volume change at a specific elevator. Rather, they are to illustrate costs at different levels under conditions, where factors other than volume that affect costs are controlled.

Obviously, as elevator storage replaces farm storage for cash grain maximum annual volume is more and more limited to what can be received during the harvest period. Therefore, the practical maximum annual volume is what can be received during the wheat harvest, plus whatever is available for market later in the year from farm storage and from other grains with a different harvest season.

Harvest receipts are so important in the competition for annual volume that the factors limiting these receipts take on great importance. Any one of such things as siding for empty and loaded box cars, number of car switches per day, elevating capacity, or flow of traffic over the truck scale and through the elevator may bring about a bottleneck. The limitations imposed by car shortages, and the number of cars that can be spotted for loading daily determine the number of cars shipped daily during the harvest season. This factor is dominant in limiting the maximum practical annual volume and in motivating additional local elevator storage capcity. Annual turnover of elevator capacity will decrease as shipments for sale and terminal storage decrease in relatioh to capacity during the harvest period. Putting it another way -- the more wheat that can be shipped for sale and terminal storage during harvest, the more turnover and the lower per bushel merchandising and handling costs.

Considering storage conditions in the hard winter Wheat Belt, as well as capacity to ship cars during the harvest season, maximum annual volume of grain merchandised or handled annually in the elevator models was: 250,000-bushels for the 20,000-bushel elevator; 400,000-bushels for the 100,000-bushel elevator; 600,000-bushels for the 200,000-bushel elevator; 900,000-bushels for the 300,000-bushel elevator; and 1,500,000-bushel annual volume for the 600,000-bushel elevator.

Maximum local capacity practical for storage use is, of course, lower than the rated capacity of the elevators involved. The maximum storage capacity actually used at any given time in the elevators included in this study was 90 percent of the new concrete elevator rated capacity, and 15,000 bushels in the 20,000-bushel elevator model. Actually wheat had to be of good quality if that much capacity is used for storage even for a short time. The only reason that such a high percentage might be used immediately following harvest is that management is sure some local storage will be sold soon, thus making more room for owned grain stocks and for turning storage stocks.

The objective of the study was to provide guides for management considering the problem of a new elevator or elevator addition. Therefore, the level of volume for the proposed facility will presumably be what management considers average for the life expectancy of the facility.

The selection of volume levels used in the elevator models was made from this viewpoint rather than to show differences in cost due to year-to-year variations. The principal difference on costs is believed to be a little more flexibility in salaries and wages. The manager's salary would tend to be a little more responsive to low volume in relation to elevator capacity when the manager is selected with a given volume in mind.

BUDGETING - HOW AND WHY BY EXPENSE ITEMS

Obviously accuracy of budgeting expense items in a model operation depends on intimate knowledge of actual operations and practical judgment. In building models of elevator operating costs, the authors of this report believed that consideration of each item of expense individually was the most accurate procedure. They, therefore, report the description of, and the reasons for procedures used in this study by individual items of expense.

All elevator costs are commonly grouped into fixed and variable expenses, fixed expense items being those related to property and facility and their valuations. Their amount is not influenced by the amount of volume. Variable expenses make up the balance of the elevators' operating expenses. Amounts of variable expenses change in varying degrees with volume and management decisions.

Because there are various degrees of rigidity in most so-called variable expenses they are further divided in this study as follows: (1) personnel expenses, (2) slow or sticky expenses, (3) other variable expenses, (4) nonoperating statement expenses. This further division of the so-called variable expenses will facilitate the discussion of the procedure used in budgeting each item of expense to the respective model elevator operations. It will also help to point up the differences in rigidity of the different expense items making up the group that vary with volume and management decisions.

The first three sub-groups of variable expense items are those included in elevator operating statements as association expense. The fourth sub-group includes those not usually shown in operating statements, such as shrinkage and quality deterioration.

Fixed Expense

Fixed expenses include depreciation, personal property taxes, capital stock or corporation tax, insurance on plant and equipment, state warehouse bond, employee bonds, and railroad lease.

These are all expense items based on valuations or a specific service necessary if the plant is to operate. They are not associated with volume changes. Once they are fairly established for a specific plant, they are not subject to change from year to year by management. Thus, their amount has a fixed character for a given plant in relation to the various volume situations that may prevail for that plant.

Depreciation

In allocating depreciation expense three factors were important in this study. They were: (1) Selecting valuations for the elevator models that accurately represent the differences due to plant size and equipment used, (2) selecting a rate that is commonly used for the particular item being depreciated, and (3) making the allocation to the primary and the two secondary operating functions on a basis that considers their functional character logically and accurately.

Construction engineers who build the types of elevators shown in Figures 1 to 5 supplied cost values for the different new facilities and equipment used in the models.

They gave data for both the buildings and the installed cost of the equipment. In order to get the most accurate relative data for the different size plants, construction firm personnel were asked to give their data on the assumption that all variation in cost due to time of building or location of the plant was eliminated. Therefore, the costs shown in Table 1 reflect accurately the difference that will exist if local management is considering different size plants for a particular location. Also, of incidental interest, is the fact that the amount of the cost is believed to be about average for building conditions existing in the western two-thirds of Kansas during the fall of 1952.

Rates of depreciation selected were those commonly used by elevator associations as determined by examination of many audit statements and consultation with auditors working in the hard winter wheat area. Common usage was more important in the study than actual depreciation, if and when there was a difference. Therefore no attempt was made to determine actual depreciation that might be applied to the facilities and equipment used in the models.

The depreciation expense on the building (valuation times rate) was allocated to the primary and the secondary operating functions on the basis of percentages shown in Table 1. Allocations were determined on the basis previously discussed on Page 8. (General basis for cost allocating).

Relative use of machinery and equipment was an important factor considered in allocating its depreciation costs. The manner and extent of use and the valuation of each piece of elevator equipment was considered in arriving at the percent of this cost to be allocated to the grain functions.

The use of equipment in the concrete elevators was based on two times the rated capacity of the elevator when being used for merchandising or handling and 90 percent of the rated capacity which was the maximum used for storage during the year. For example, in a 100,000-bushel elevator, this meant elevating 400,000 bushels when merchandising or handling 200,000 bushels.

Since turning stored stocks was at an annual rate of 3 times maximum capacity used for storage, it meant elevating 270,000 bushels during the year. Thus, bushels elevated for the storage function were about 40 percent of the total. However, not all elevator machinery and equipment is used for turning storage stocks. More important then was the fact that the machinery used was also essential if the elevator did not store grain. Furthermore, installation was a substantial part of the machinery and equipment costs on which fixed costs were calculated. Installation of legs and motors and a substantial part of the spouting and dust collecting equipment are necessary regardless of the storage function. Therefore, all points considered, 25 percent of the elevator equipment shown in Table 1 was considered to be the excess and was used in allocating these costs to the storage function for the all-gravity-flow concrete elevators.

For the larger facilities 41 percent of the cost was allocated to storage because of the difference in the treatment of the elevator addition from that of the main elevator or workhouse. The allocation for the 20,000-bushel elevator was 15 percent to storage for the same general reasons as pointed out in the discussion of the allocation for the all-gravity concrete elevators.

Table 1 - Percentage allocation of fixed expense amounts and valuations used as a basis for calculating depreciation, insurance on plant and equipment, and property taxes.

Facility or Equipment	Depreciation valuation 1/	Percentage allocation of depreciation expense by functions		
		Sidelines	Grain merchandising or handling	Grain storage
Elevator building				
Old 20,000-bu.	none2/	--	--	--
New 20,000-bu.	15,015	--	60	40
New 100,000-bu.	65,000	--	40	60
New 200,000-bu.	104,000	--	30	70
New 300,000-bu.	142,000	--	25	75
New 600,000-bu.	227,000	--	20	80
Elevator equipment for				
Old 20,000-bu.	6,000	--	85	15
New 20,000-bu.	8,200	--	85	15
New 100,000-bu.	25,000	--	75	25
New 200,000-bu.	32,000	--	75	25
New 300,000-bu.	38,000	--	75	25
New 600,000-bu.	64,000	--	59	41
Office				
Building	2,000	--	100	--
Equipment and truck scales	5,000	--	100	--
Sidelines				
Warehouse	4,000	100	--	--
Bulk petroleum tanks	8,000	100	--	--
Bulk petroluem equipment	8,000	100	--	--

1/ Depreciation values were considered to be both cost and net fixed asset values for the purposes of this study.

2/ For insurance purposes the old elevator building was considered to have a replacement value of $7,500.

Table 2 - Valuation, rates and amounts of depreciation allocated to major functions of elevator operations used in study models.

Facility or Equipment	Valuation	Rate	Total amount	Allocation by functions: Side-lines	Allocation by functions: Grain merchandising or handling	Allocation by functions: Grain storage
Elevator building						
Old 20,000-bu.	none	--	$ --	$--	$ --	$ --
New 20,000-bu.	15,015	5	750	--	450	300
New 100,000-bu.	65,000	3	1,950	--	780	1,170
New 200,000-bu.	104,000	3	3,120	--	936	2,184
New 300,000-bu.	142,000	3	4,260	--	1,065	3,195
New 600,000-bu.	227,000	3	6,810	--	1,362	5,448
Elevator 1/						
Old 20,000-bu.	6,000	10	600	--	510	90
New 20,000-bu.	8,200	10	820	--	697	123
New 100,000-bu.	31,000	10	3,100	--	2,325	775
New 200,000-bu.	38,000	10	3,800	--	2,850	950
New 300,000-bu.	44,000	10	4,400	--	3,300	1,100
New 600,000-bu.	70,000	10	7,000	--	4,130	2,870
Office						
Building	2,000	5	100	--	100	--
Equipment and scales	5,000	10	500	--	500	--
Sidelines						
Warehouse	4,000	5	200	200	--	--
Bulk oil tanks	8,000	5	400	400	--	--
Bulk oil equipment	8,000	10	800	800	--	--

1/ Concrete elevators of 100,000-bushels capacity and up include equipment worth $6,000 in old elevator operated in conjunction.

Insurance - Buildings and Equipment

Insurance coverages were based on the valuations for buildings and equipment shown in Table 1, except in the case of the old 20,000-bushel elevator. This was completely depreciated on the books but was considered to have a replacement value of $7,500. This amount was used plus the $6,000 for the old elevator equipment in calculating insurance coverage for the old elevator. The amount of coverage, in all models, was 80 percent of cost or replacement value. By using 80 percent coverage in each of the models, variations found in actual records due to different extent of coverage and different valuations on the same size elevators were eliminated.

Variation was also eliminated, as compared to actual coverages used by different elevators, by making the kind of fire and extended coverage the same for each model.

Rates per $100 of coverage shown in Table 3 were selected as being about the average of those found in use for the different kinds of facilities. Many factors and conditions were used in determining a rate for a given elevator. Rates in new concrete elevators vary from about 11 to 20 cents per hundred dollars of coverage, depending on housekeeping and dust control practices, type of electrical installation, and other similar factors.

The rates used (Table 3) were believed to be accurate in reflecting the differences in the type of construction of plant and facility used in the models.

Allocation of insurance costs for plant and equipment to the three major operating functions was made on the same percentage basis as previously shown for depreciation (Table 1). While the result of the allocation was the same, the method of calculating was different because of the fact that insurance coverage was for both plant and equipment. In the case of depreciation, plant and equipment were allocated not only separately but differently. Therefore, calculation for insurance was a combination of the two allocations which was comparable to adding the depreciation allocation for the elevator plant to the allocation for elevator equipment.

Personal Property Taxes

It was impossible to determine a uniform formula for establishing tax valuations from tax receipts and other records available at the elevator. Of course, rates and amount of taxes were shown on the receipts from which assessed values could be calculated. But these records were available only for all association property. They were not broken down by kinds of property, as was needed to allocate costs to the operating functions used in the study. Therefore, it was necessary to develop a figure that could be applied to the value of the various properties making up net fixed assets in order to make an allocation of personal property taxes that would be accurate for this study.

Table 3 - Insurance on buildings and equipment - its coverage rate and allocation by major functions of elevator operations used in study models.

Facility or equipment	Amount of fire and extended coverage	Rate per $100	Allocations by Functions 1/		
			Side-lines	Grain merchandising or handling	Grain storage
Elevator facility and equipment					
Old 20,000-bu.	$ 10,800	$1.40	$ --	$107	$ 44
New 20,000-bu.	19,370	1.00	--	135	59
New 100,000-bu.	72,000	.16	--	58	57
New 200,000-bu.	109,000	.16	--	70	104
New 300,000-bu.	144,000	.16	--	81	149
New 600,000-bu.	233,000	.16	--	102	271
Office, scale and equipment	5,500	.60	--	33	--
Sidelines					
Warehouse	3,200	1.40	45	--	--
Bulk oil plant and equipment	12,800	1.80	230	--	--

1/ Allocation is for both plant and equipment and gives the same weight to plant and equipment as is used in allocating each separately in Table 1 for depreciation.

Checks made at different elevators indicated a wide variation in assessed value of all property in relation to net fixed assets. Because of this variation a large sample was needed.

Records were available from the 1951 Kansas survey of all cooperative elevators in the State showing personal property taxes, kinds of facilities, and the net investment in facilities. From these records of about 250 country elevator operations, a selection was made of all elevators in the group which had plants and equipment comparable to those used in the models. From this selection, personal property taxes paid were divided by net facility and equipment cost. The average of these calculations was $1.37 per $100 of net fixed assets value. Thus the authors developed a figure that could be applied to the component parts of net fixed assets. The result was a property tax amount comparable to the average actually paid by a large number of operating associations. This gave a rate that could be applied to the various properties making up net fixed assets and one that could be allocated more accurately to functions.

This calculated $1.37 rate per $100 of net fixed assets was applied to each of the valuations shown in Table 1 for depreciation. The resulting amount was allocated as personal property tax cost to the three major functions on exactly the same basis as that shown for depreciation.

Bonds and Licenses

The license and bond costs for the models were those specified by the State of Kansas and were set up as fixed expenses for the purpose of this study. Kansas elevators used a State warehouse license more frequently than a Federal license. In 1952, Kansas warehouse bond costs were set at 20 cents per bushel of rated elevator capacity. For example, the bond for a 100,000-bushel elevator was $20,000.

Cost of the bond was calculated by most bonding firms at $5 per $1,000 of bond up to $10,000; $2.50 per $1,000 for the next $15,000; and $1.25 per $1,000 for all above $25,000. So, in the model of the 10,000-bushel elevator, annual cost of the bond of $20,000 was $75. This was strictly a grain storage expense and it was allocated that way.

The manager's bond is another fixed expense. The amount of this bond and its cost vary considerabl with different installations. The amount is usually determined by the association directors, and once the determination is made it usually stays the same for several years or until a substantial change occurs in the business. For this study it was a fixed expense. The cost was $50 annually in each of the examples used. This amount may be considered a little high for models of the smaller operations, but where the manager and board of directors were rated good by the criteria assumed in this study, the amount of the bond did not vary substantially with size of operation.

Total Fixed Costs

Fixed costs of depreciation, insurance, personal property taxes, bonds and licenses, and railroad lease are summarized for the three major elevator operating functions as follows:

Table 4 - Fixed costs and their allocation to the three major operating functions in each of the study models.

Item and Model	Total fixed cost	Allocation of fixed costs: Side-lines	Allocation of fixed costs: Grain merchandising or handling	Allocation of fixed costs: Grain storage
Sideline volume of $30,000 elevator				
Old 20,000-bu.	$ 1,962	$300	$1,491	171
New 20,000-bu.	3,211	300	2,305	606
New 100,000-bu. plus old 20,000	7,845	300	4,780	2,765
New 200,000-bu. plus old 20,000	10,461	300	5,640	4,521
New 300,000-bu. plus old 20,000	12,914	300	6,379	6,235
New 600,000-bu. plus old 20,000	19,968	300	7,895	11,773
Sideline volume of $145,000 elevator				
Old 20,000-bu.	3,566	1,904	1,491	171
New 20,000-bu.	4,815	1,904	2,305	606
New 100,000-bu. plus old 20,000	9,449	1,904	4,780	2,765
New 200,000-bu. plus old 20,000	12,065	1,904	5,640	4,521
New 300,000-bu. plus old 20,000	14,518	1,904	6,379	6,235
New 600,000-b8. plus old 20,000	21,572	1,904	7,895	11,773

The manager's bond is an expense that will be about the same if the entire operation is limited to the primary function - grain merchandising or handling. The secondary functions have very little influence on this cost item. So the entire cost was allocated to grain merchandising or handling.

Railroad Lease

This is another expense that remains the same from year to year for a given elevator operation that continues leasing the same amount of siding and land from the railroad. It, of course, does vary with the amount leased. The larger elevators usually have a larger land area leased and pay more for it.

The annual railroad lease costs used in the models by size of elevators were: 20,000-bushel capacity - $15; 100,000-bushel plus 20,000-bushel old elevator - $50; 200,000-bushel plus 20,000-bushel old elevator - $75; 300,000-bushel plus 20,000-bushel old elevator - $125; and the 600,000-bushel new elevator plus the 20,000-bushel old elevator - $200.

The railroad leases was a cost of the primary function - grain merchandising or handling for grain owned by Commodity Credit Corporation, and was all allocated to that function of the operation.

Personnel Expenses

In addition to salaries and wages paid to elevator employees, social security taxes and workmen's compensation are also included in personnel expenses. Personnel expenses could logically have been classified with the group of expenses that are sticky in their response to volume changes. However, they were put in a separate group for the following reasons: (1) They constituted a relatively large part of total operating expense -- half or more of the out-of-pocket expense in some of the study models; (2) they were important enough to the study objective and allocation procedure to be emphasized.

Workmen's compensation insurance, and social security taxes were included because they were directly associated with personnel payroll. Their allocation was on the same percentage basis as salary and labor expense.

The authors used three sources of information in developing a salary schedule for the study models that would be about average for employees being paid under actual operating conditions. They were:

1. The survey made in 1951 of all cooperative elevators in Kansas. which grouped elevators according to size of facility and type of sideline operation. The average of each group provided an important guide for the salary schedule selected.

2. Cooperative leaders in Kansas who were working constantly with elevators and gave their estimates for the manager's salary, as well as for salaries of other elevator personnel. They consider these estimates typical of the situations to be illustrated in the models.

3. Field observations made during the study of individual cases, as well as other observations made during the course of other recent studies.

In the discussion of personnel expenses that follows, the level of personnel compensation was not important to the study except in the attempt to use salaries typical at the time the study was made. The primary objective was to develop a functional allocation formula with practical application over a long period in calculating costs by function, regardless of the level of salaries that might be in effect at a specific time and location.

Manager's Annual Salary

Some managers receive a commission or a percentage of the association's net saving, in addition to an annual salary. Such a commission is associated with volume to the extent that volume influences net savings. Such arrangements for a manager's compensation are in the minority. A much larger group of managers receive a salary that constitutes their entire compensation from the association hiring them. Therefore, this study used the manager's salary as his entire compensation.

Table 5 - Manager's annual salary for the study models at a specified volume.

Elevator model capacities	Bushels of Grain volume merchandised or handled	Storage Capacity in bushels used	Manager's Salary by Sideline Volume	
			$30,000	$145,000
Old 20,000-bu.	150,000	15,000	$3,200	$3,600
New 20,000-bu.	150,000	15,000	3,200	3,600
New 100,000-bu. plus 20,000 bu.	200,000	90,000	3,800	4,200
New 200,000-bu. plus 20,000 bu.	400,000	180,000	4,400	4,800
New 300,000-bu. plus 20,000 bu.	600,000	270,000	5,000	5,400
New 600,000-bu. plus 20,000 bu.	1,200,000	540,000	--	6,400

Table 5 shows the manager's annual salary at a specific point of grain volume merchandised or handled and stored, and by sideline volume and size of elevator facilities used. As the size of the grain facilities increased from the 20,000-bushel elevator to the 300,000-bushel new elevator, compensation increased at $600 annually at volumes specified.

Using the $30,000 annual volume of sidelines as the base, the manager's compensation was $400 higher for each of the different size elevator facilities.

The manager's salary is also influenced by the level of grain volume handled and stored at any given size facility. The change in manager's salary due to the level of annual grain volume in any given size facility was selected as follows:

1. A decrease of $200 in annual salary from that shown in Table 5 with each decrease of 100,000 bushels of annual volume to an annual turnover of the rated capacity of the elevator, or an annual volume of 100,000 bushels -- whichever was reached first.

2. Conversely, an increase of $200 with each increase of 100,000 bushels of annual volume merchandised or handled up to 300,000 bushels, or to three times elevator rated cpacity -- whichever was greater. Three times turnover was selected because this was considered to be the maximum practical annual turnover in the larger country elevators for the region to which the study applied. A possible exception would be years of extremely big crops, during which it is necessary for farmers to use much more farm storage.

Allocation of Manager's Salary to Functions

On the basis that grain merchandising or handling was the primary function of the elevator association or company, and that sideline operations and grain storage were secondary, only that portion of the manager's salary representing actual time devoted to such secondary activities was charged to them. The remainder including all idle time -- was charged to grain merchandising and handling as the primary operating function.

Therefore, with sideline volume at $30,000 and the manager doing the bookkeeping, $800 of his salary was allocated to sidelines. When a bookkeeper was hired the allocation was divided equally between the manager and the bookkeeper.

When petroleum bulk plant operations were added and sideline volume increased to $145,000, allocation to sidelines was increased to $1,400. This was all allocated from the manager's salary when he did the bookkeeping. When all volume justified hiring a bookkeeper the allocations were $800 and $600 respectively for manager and bookkeeper salaries.

After the allocation to sideline was made, the balance was grain expense, from which a part was allocated to the other secondary function -- grain storage. Field observations indicates that about one-half the manager's time devoted to the storage function, would normally be handled by a bookkeeper when one was available. Therefore the proportion of each salary -- manager's and bookkeeper's -- allocated to the storage function was the same. Or when the manager handled all bookkeeping and accounting, the amount that would have been allocated to storage from the bookkeeper's salary was also allocated from the manager's salary.

Field observations indicated that about 5 percent of the time of a manager who operated a 20,000-bushel elevator with the help of a bookkeeper was actually devoted to the storage function. In the 100,000-bushel and larger country elevator, the time devoted to the storage function was 10 percent, when a bookkeeper is employed. These percentages were used as a basis for allocating manager's salary except when the manager did the bookkeeping. In that situation the 10 percent allocated from the beginning part-time bookkeeper's salary was included as an additional allocation of manager's salary.

Bookkeeper's Salary

This study assumed a part-time bookkeeper was hired when grain volume merchandised or handled reached 250,000 bushels annually. Compensation at this volume was $1,400 for a years time. For this compensation the bookkeeper worked afternoons 24 hours each week. As volume increased the bookkeeper's working time increased, as did compensation, at a rate of $100 for each increase of 100,000 bushels of volume up to a 500,000-bushel annual volume. At this point a full-time bookkeeper was employed at a minimum annual salary of $2,200 annually. From the 500,000-bushel volume point, salary increased at the same rate as indicated for part-time salary until a volume of 800,000 bushels was reached. From that point the rate of increase was $25 per 100,000 bushels of additional annual grain volume merchandised or handled.

Allocation of bookkeeper's salary to the storage function was -- as has been indicated under the discussion of manager's salary -- 5 percent after sideline allocation was deducted in the 20,000-bushel elevator and 10 percent in the 100,000-bushel or larger elevator.

Elevator Men's Salaries

The so-called first elevator man is usually considered the second in command in an elevator operation. However, when he and the manager are both on the job his primary responsibilities are (1) the elevator and its mechanical operation, and (2) the feed warehouse and labor needed there. Of course, the manager will also assist when needed on either of these jobs, but he usually delegates to the elevator man major responsiblity for the day-to-day routine operating jobs at both the elevator and the warehouse.

In this study the salary scale for this job at the grain volume indicated in Table 5 was as follows: $2,600 for the 20,000-bushel elevator; $2,800 for the 100,000-bushel; $3,000 for the 200,000-bushel; $3,200 for the 300,000-bushel; and $3,600 for the 600,000-bushel elevator. There was no variation from this basic salary schedule because of the sideline volume handled in the models used, as the elevator man's responsibility was only for the flat warehouse activities.

The first elevator man's annual salary varied with grain volume merchandised or handled as follows: (1) It decreased at the rate of $50 per 100,000-bushel decrease in volume to 100,000 bushels or the rated elevator capacity -- whichever was reached first; and (2) it increased at the same rate until volume equaled three times the rated elevator capacity or 300,000 bushels -- whichever was the larger volume -- or to a maximum annual salary of $3,800.

Allocation of $900 of the elevator man's salary was made to sidelines when volume was $30,000 and an allocation of $1,100 was made when sideline volume was $145,000. The remainder of the salary was grain expense, of which 15 percent was allocated to storage and 85 percent to grain merchandising or handling in elevators of 100,000-bushel capacity or larger. In the 20,000-bushel elevator, 5 percent instead of 15 percent was allocated to storage.

A second full-time elevator man was added to the new elevator operation when annual grain volume merchandised or handled reached 900,000 bushels annually. Starting salary was $2,600. This salary increased at the rate of $50 per 100,000-bushel increase in volume above 900,000 bushels to three times turnover or to $3,000 -- whichever was reached first. All the second elevator man's salary was allocated to the primary function -- grain merchandising or handling.

Extra Elevator Labor Costs

Extra elevator labor is the part-time help during the harvest season and other times when the work load is heavier than usual. This is unskilled labor used for such tasks as coopering cars, helping to dump trucks, and other such work as may be directed by the manager and the first elevator man. The usual rate at country elevator points is $1.00 an hour during the harvest season and 80 cents at other times.

The amount of extra labor hired varies with volume merchandised or handled and the number of regular employees.

The expense of extra labor in the situations used in the models was all charged to grain merchandising and handling.

Petroleum Tank-Truck Operators' Salaries

In this model two men were employed for the exclusive purpose of handling the bulk petroleum products operations. They took care of the mechandical operations of the bulk plant facilities and equipment. They operated the trucks delivering petroleum from plant to farm. They were responsible also for field contacts with farmers to solicit sales and collect accounts receivable.

Their annual sales were $112,000 direct from their trucks, and another $3,000 worth of packaged oil and grease was sold direct from the warehouse by other employees, making total petroleum products sales of $115,000 annually.

Each of the two petroleum truck operators received a salary of $3,000 annually. The allocation of this salary was all to the sideline function of the operation.

Social Security Tax

The employer pays 1.5 percent of the employee's salary up to the point at which the annual salary reaches $3,600. Above a $3,600 salary, social security tax is not deducted. Allocation of this expense item was at the same percentage as has been explained for all salaries and wages up to $3,600 annually.

Workmen's Compensation Insurance

Another expense item based on payroll is workmen's compensation insurance. The rate of the insurance per $100 of payroll depends on the risk involved in the particular job covered. Observations made in Kansas indicated that the most common rate for coverage of persons whose principal work was in the elevator was $1.63 per $100 of insurance coverage based on salary. Actually rates observed for country elevators in the new modern elevators varied from $1.60 to $1.71 per $100 of coverage. Of course, with bad accident experience or unusual hazards for elevator employees this rate might be considerably higher.

There was a rather wide range in rates for employees working mostly in warehouses, stores, or lumber yards. Those observed ranged from 32 cents to $1.30 per $100 of coverage.

Rates for those working primarily on gasoline and oil tank trucks and bulk plant operations ranged from $1.10 to $1.40 in cases observed. Of course, as already pointed out, these rates could have a considerably larger range, particularly on the higher side, with a larger number of cases that might include higher risk coverages.

Rates for employees working entirely in the elevator office, such as bookkeepers, were lowest. Rates for those observed were 3 to 4 cents per $100 coverages.

All rates but those for the bookkeeper in the models used carried the elevator employee rate or a combination elevator-warehouse rate. Considering everything, including simplicity in calculating this cost item for budgeting purposes, a rate of $1.45 per $100 coverage was calculated as about an average cost of workmen's compensation for the types of operation used in the models. Distribution of this cost was at the same percentage to the operating functions as the cost of salaries and wages.

Total and Their Allocation

It is important to have in mind that each total for salary, wages, workmen's compensation, insurance, and social security expenses shown in Table 6 was for a different grain or sideline volume situation. In addition to a different level of manager's salary due to size of grain facilities there were also different numbers of other employees and levels of salaries due to volume.

A part-time bookkeeper was added to the employees -- manager and elevator man -- when grain merchandising or handling volume reached 250,000 bushels. Beginning at a volume of 500,000 bushels the bookkeeper became a full-time employee. A second elevator man was added when grain volume reached 900,000 bushels. The models showing bulk petroleum products added two full-time employees at a total annual cost for these expenses of $6,155. Extra elevator labor increased up to the point where an additional part or full-time employee was added to help with grain operations. All these things together added up to the differences shown in Table 6.

Slow or Sticky Expenses

There are items often referred to as variable expenses that are slow or sticky in their response to volume changes. These are such expenses as utilities, advertising, donations, auditing, repairs, directors' fees, and travel. They are often characterized by a minimum, either actual, as in the case of electric power, or set by the manager as in the case of advertising or donations.

While these expense items vary to some extent with the level of annual volume, this variance is not in a direct relation. Other so-called variable expenses such as office supplies, and insurance on stocks and plant supplies vary more directly with volume than the groups just mentioned and are therefore called variable expenses in this study report. So, the word slow or sticky is more descriptive than the word variable for the so-called variable expenses that are less responsive to volume change. Also, by dividing the so-called variable expenses into two groups -- slow or sticky, and other variable -- the description of expenses in each group is more accurate, and each group is better adapted to the budgeting procedure.

Electric Power

The authors did considerable field sutdy on the problem of developing a procedure that would accurately reflect typical power costs by operating functions for various size elevators and equipment, and for various volume situations in a given size elevator and equipment. The specific objective was to determine bushels of grain elevated per kilowatt hour (KWH) consumed for application to the models. There was also the problem of rates per KWH used, and minimum monthly cost per connected horsepower. When these factors were applied to bushels of grain elevated by functions, they resulted in power cost by functions typical for the equipment and volume used in the models.

Field observations were helpful on this problem, but the variations observed created doubt that an average of those observations would result in a typical power bill. To test field observations, the average on bushels elevated per KWH, rates and minimum monthly bills were all calculated and power costs determined for the study models. These results were compared to actual power bills of all cooperative elevators in Kansas that appeared to be similar to those used in the models. The calculated power costs were close to the average of the actual power bills. Therefore the averages for field observations were used in calculating power costs and the following results were derived:

(1) Forty bushels were elevated per KWH of electricity used.

(2) Rates were: 5 cents for the first 100 KWH; 4-1/2 cents for the next 100; 3 cents for the next 300; 2-1/2 cents for the next 2,000; and 1-1/2 cents for all over 2,500 KWH used monthly.

(3) The minimum monthly power bill was 55 cents for each connected horsepower in the elevator motors.

The 55-cent minimum was multiplied by the total connected horsepower being used to determine the monthly minimum power cost. Average monthly bushels elevated for the merchandising or handling function were divided by 40 to get KWH consumption. The rate schedule was then applied to this consumption to obtain the average monthly power cost. Average monthly power cost was multiplied by 12 to get annual power costs for the primary function.

Table 6 - Total salaries, wages, workmen's compensation insurance, and social security tax for each of the study models at a specified volume.

Elevator models	Grain merchandised or handled annually in bushels	Maximum storage capacity used in bushels	Total of the expense	Allocated to functions of		
				Sidelines	Grain merchandising or handling	Storage
Old and new 20,000-bu.	150,000	15,000	$ 6,177 1/ 12,663 2/	$1,750 8,751	$ 4,175 3,660	$ 252 252
New 100,000-bu. plus old 20,000-bu.	200,000	90,000	7,106 1/ 13,592 2/	1,750 8,751	4,646 4,131	710 710
New 200,000-bu. plus old 20,000-bu.	400,000	180,000	9,716 1/ 16,202 2/	1,750 8,751	7,112 6,597	854 854
New 300,000-bu. plus old 20,000-bu.	600,000	270,000	11,406 1/ 17,881 2/	1,750 8,751	8,632 8,106	1,024 1,024
New 600,000-bu. plus old 20,000-bu.	1,200,000	540,000	1/ No example used 22,741 2/	8,751	12,238	1,220

1/ Salaries, wages, workmen's compensation insurance, and social security expense when sideline sales were $30,000 annually made from feed and miscellaneous production supplies all handled from the warehouse.

2/ The same expenses when $115,000 worth of petroleum products and a bulk petroleum plant operation were added to sidelines handled in 1/.

Average monthly costs were used because factual records were not available to determine the exact time and number of bushels elevated for turning storage stocks. Daily bushels of grain receipts and shipments were determined during the field observations but, because of the lack of exact turning data, total monthly bushels elevated would have been an estimate.

Use of an average monthly power bill does not take into account variation during the year when minimum power bills may be a factor in annual costs. As a rule management will be turning storage stocks on days and during months when receipts and shipments are lowest, which will in part level out bushels elevated per month compared to monthly receipts and shipments.

Two times volume handled or merchandised was used in figuring KWH consumption for this function. Some harvest receipts have only one elevation when being loaded directly into a car. On the other hand more than two elevations may occur in connection with the primary functions when grain is rebinned or conditioned for merchandising purposes.

Elevation for the storage function was figured at three times maximum capacity used for storage. For example, an elevator using as much as 90,000 bushels of its capacity for storage stocks would elevate 270,000 bushels during the year. Considering that storage stocks during the year decrease from the maximum used, this would allow for turning of actual storage stocks about five times during the storage year, even in a year when most of the elevator's storage stocks pass from farmers to C.C.C. ownership.

The same procedure was used in calculating average power costs for the secondary function -- grain storage -- except for the part of the rate schedule used. After determining monthly KWH used for merchandising or handling the rate used was that part of the rate schedule applicable to KWH consumed that were in addition to the number consumed by the primary function. For example, 400 KWH were consumed by the primary function monthly. Using the rate schedule, the first 400 KWH would cost $15.50 x 12, or $186 annually for the primary function. Power consumption for the storage operating function was then determined to be 700 KWH monthly. Beginning with 400 KWH consumed for the primary function, the rate application for the storage calculation was another 100 KWH at the 3-cent rate with the remaining 600 at the 2-1/2-cent rate or $18 x 12, which amounted to $216 annually.

The total monthly power bill for the above example was $15.50 plus $18.00, or $33.50. The next question was, how that compared with the monthly minimum? Assuming the above monthly consumption of KWH was for the new 100,000-bushel elevator, whose operators still had their old 20,000-bushel elevator also; their combined connected horsepower was 62-1/2. At the 55-cent minimum per connected horsepower, the monthly minimum was $34. Cost based on actual consumption was 50 cents less than the monthly minimum. The 50 cents monthly, or $6 annually, was added to the calculated cost of the primary function. Thus $186 plus $6, or $192, was the allocation to the primary operating function of grain merchandising or handling.

This method of calculation resulted in higher cost for the primary function than for the storage function in relation to respective bushels elevated. It was selected as the best possible method of calculating power cost for these two major operating functions for the following reasons:

(1) Grain merchandising or handling grain for C.C.C. was the primary function.

(2) The number of bushels elevated did not take into account the use of the power consumed by the truck hoist motor, which was used exclusively in the primary function. Neither did it consider the small man-lift motor in the new elevator which would be used mostly for the primary function.

(3) Most of the variation in monthly bushels elevated was due to seasonality of receipts and shipments. Without storage this would logically result in more months in which the minimum power was not consumed as compared with the average monthly bushels elevated used in the above calculations.

(4) Considering records that may be available to country elevator management, the foregoing calculations will be easier for them to make than will other possible methods of calculation of these costs for the two operating functions.

Table 7 - Horsepower represented in the electric motors used in the models.

Elevator models	Old elevator	New elevator	Total
New 20,000-bu.	--	20 hp.	20 hp.
Old 20,000-bu.	20 hp.	--	20 hp.
New 100,000-bu. and old 20,000-bu.	20 hp.	42-1/2 hp.	62-1/2 hp.
New 200,000-bu. and old 20,000-bu.	20 hp.	52-1/2 hp.	72-1/2 hp.
New 300,000-bu. and old 20,000-bu.	20 hp.	62-1/2 hp.	82-1/2 hp.
New 600,000-bu. and old 20,000-bu.	20 hp.	133 hp.	153 hp.[1]

[1] This elevator has two 50-hp. motors instead of 1 leg-head motor plus 2 small conveyer motors, in addition to the regular electrical motors found in the 200,000-bushel elevators.

Lights

The cost of 110-volt electricity for elevator and for office lights was determined from field audits of the monthly bills of the elevators studied. Distribution to the three major functions was made on the basis of salary and labor allocations. This method appeared to be the most logical for distributing the cost of this item, since lights are installed for the convenience and safety of elevator personnel.

The larger the elevator the more lights connected; thus the amount of the light bill was increased with the size of the elevator. Petroleum operation required more electricity for pumps and accounting than some other operations. Therefore, the light bill was higher where the elevator handled petroleum. The increase chargeable to petroleum was $10. So $5 was allocated to feed and $10 to petroleum plus the $30 for the 20,000-bushel elevator and an additional $15 for each 100,000 bushels of capacity.

Table 8 shows these costs for each of the models. Light costs for grain merchandising or handling changed at a rate of $2 for each change of 100,000 bushels in volume.

Table 8 - Budget figures for light and other 110-volt electricity costs for the models at specified volumes for each of the three operating functions.[1]

Elevator models	Sideline Volume	Expenses and allocations by functions			
		Total	Side-lines	Grain merchandising or handling	Grain storage
Old or new 20,000	$ 30,000	$ 35	$ 5	$ 28	$ 2
Old or new 20,000	145,000	45	15	28	2
New 100,000 plus old 20,000	30,000	50	5	40	5
New 100,000 plus old 20,000	145,000	60	15	40	5
New 200,000 plus old 20,000	30,000	65	5	54	6
New 200,000 plus old 20,000	145,000	75	15	54	6
New 300,000 plus old 20,000	30,000	80	5	67	8
New 300,000 plus old 20,000	145,000	90	15	67	8
New 600,000 plus old 20,000	145,000	135	15	108	12

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[1] 20,000-bu. old and 20,000-bu. new elevator grain volume was 150,000-bu. merchandised and 15,000-bu. stored. Sideline volume was $30,000 for feed and $145,000 for feed and petroleum. Grain volume was 2 times new elevator capacity. Storage used was 90 percent of new elevator capacity.

Heat

The elevator management used fuel oil to heat the office. Amounts used were determined for this study from fuel bills of the associations studied. Since this item was all for the office, the cost was distributed to the two grain functions, merchandising or handling, and storage on the same percentage basis used to allocate manager and bookkeeper salaries. This cost changed slightly with the number of patrons who entered or left the office. Of the total heat bill $5 was allocated to sidelines when volume was $30,000 and $10 when it was $145,000. The remainder was allocated to the storage function and grain merchandising or handling on the same basis as manager and bookkeeper salaries -- 5 percent for 20,000 bushel elevators and 10 percent on all large elevators. With each change of 100,000 bushels of grain merchandised or handled, the heat bill chargeable to the two grain functions increased by $2.

Table 9 - Budget figures for office heat for the study models at specified volumes for each of the three operating functions. 1/

Elevator models	Sideline Volume	Expenses and allocations by functions: Total	Sidelines	Grain merchandising or handling	Grain storage
Old and New 20,000-bu.	$ 30,000	$75	$ 5	$67	$3
Old and new 20,000-bu.	145,000	80	10	67	3
New 100,000-bu. plus old 20,000	30,000	77	5	65	7
New 100,000-bu. plus old 20,000	145,000	82	10	65	7
New 200,000-bu. plus old 20,000	30,000	81	5	69	8
New 200,000-bu. plus old 20,000	145,000	86	10	69	8
New 300,000-bu. plus old 20,000	30,000	85	5	72	8
New 300,000-bu. plus old 20,000	145,000	90	10	72	8
New 600,000-bu. plus old 20,000	145,000	96	10	77	9

1/ 20,000-bu. old and 20,000-bu. new elevator grain volume was 150,000-bu. merchandised or handled and 15,000-bu. stored. Sideline volume was $30,000 for feed and $145,000 for feed and petroleum. Grain volume was 2 times new elevator capacity. Storage used was 80 percent of new elevator capacity.

Water

Water is used almost entirely in the office in about the same way as previously described for lights and heat. Field observations indicated the following to be applicable for use in the models:

1. A minimum bill of $1.50 monthly or $4.50 quarterly. The minimum was the cost for the 20,000-bushel old or new elevator with $30,000 sideline volume, 150,000 bushels of grain merchandised or handled, and 15,000 bushels peak storage volume.

2. From that point, the increase was $1 per 100,000 bushels of grain volume merchandised or handled and $2 for an additional $115,000 of sideline volume.

3. Allocation was $4 annually for $30,000 sideline volume and the additional $5 for $145,000 sideline volume. The remainder of the total annual cost was allocated to the two grain functions, merchandising or handling, and storage, on the same percentage basis as was used to allocate manager and bookkeeper salaries.

Telephone and Telegraph

The monthly minimum telephone bill was $3, which was all charged to the primary function -- grain merchandising or handling. When a full-time bookkeeper was used and an extension telephone was added, the minimum was $4 monthly or $48 annually.

A country elevator manager customarily makes collect calls when selling grain or buying farm supplies. Therefore, toll calls are largely a result of calls on other exchanges to farmer patrons or special calls for information, repair service, or similar reasons.

Field observations indicated that these toll calls averaged about $2 monthly or $24 annually for the sideline function when volume was $30,000 and twice that amount when volume was $145,000.

Table 10 - Telephone and telegraph annual expense for the models at specified volume for each of the three operating functions. 1/

Elevator Models	Sideline Volume	Expenses and allocation by functions 2/		
		Total	Sidelines	Grain merchandising or handling
Old or new 20,000-bu.	$ 30,000	$ 96	$24	$ 72
Old or new 20,000-bu.	145,000	120	48	72
New 100,000-bu. plus old 20,000-bu.	30,000	101	24	77
New 100,000-bu. plus old 20,000-bu.	145,000	125	48	77
New 200,000-bu. plus old 20,000-bu.	30,000	123	24	99
New 200,000-bu. plus old 20,000-bu.	145,000	147	48	99
New 300,000-bu. plus old 20,000-bu.	30,000	133	24	109
New 300,000-bu. plus old 20,000-bu.	145,000	157	48	109
New 600,000-bu. plus old 20,000-bu.	145,000	187	48	139

1/ Grain volume merchandised or handled was 150,000 bu. for the 20,000-bu. elevator and 2 times rated capacity of the new concrete elevator. Maximum storage capacity used was 15,000 bu. in the 20,000-bu. elevators and 90 percent of rated capacity in each model of the new concrete elevators.

2/ No allocation to storage.

Toll calls for grain merchandising or handling varied slightly with volume -- $5 annually with each change of 100,000 bushels in volume. As volume was 200,000 bushels greater in the model (Table 10) of the 300,000-bushel new elevator than in the 200,000-bushel elevator, toll calls were $10 higher.

Telegrams were usually sent collect. But on the relatively few occasions when they were not sent collect, they were charged to the telephone bill.

Scale Testing, Adjustment, and Repair

Kansas provides an inspector to check scale accuracy and, where needed, to make adjustments and minor repairs. This inspector calls at the elevator at least once a year and oftener if asked or if the situation demands more frequent checks. He bases his charge on the size of the scale and the type of scale beam or recording mechanism.

In the models used in this study, the truck scales were all alike. The loading-out scale increased in size or capacity with an increase in size of the elevator. Another factor that has some influence on this cost is the general level or scale of grain operations. The larger elevators tend to use their scales more; thus their scales require a little more adjustment or more frequent inspection.

Based on the foregoing situation, the following costs for scale testing were selected as being representative of the operations used in the study: The 20,000-bushel elevator -- $40; 100,000-bushel -- $50; 200,000-bushel -- $60; 300,000-bushel -- $75; and the 600,000-bushel elevator with the 20,000-bushel old elevator was $100 annually. In other words the change per 100,000 bushels of volume merchandised or handled was $5. The scales were used for receiving and loading out grain, all of which -- in the hard winter wheat areas -- was either purchased and sold or handled for C.C.C. Therefore, this expense was charged to the grain merchandising or handling function.

Repairs and Maintenance

Certain aspects of repair and maintenance expense have little relation to volume. For example, painting or other care given the exterior wood or concrete is a result of weathering, rather than volume. This type of expense tends to occur every few years regardless of volume. The amount included here was intended as a yearly average of this kind of expense.

On the other hand repair and maintenance of such equipment as leg belts and buckets, car loading spouting, and spouting to and from bins are directly associated with volume. A certain guage steel spouting will wear out with a given volume.

Repairs on electric motors and other moving equipment also tend to be closely associated with grain volume.

Actually $250 annually was included for repair and maintenance expense of the old 20,000-bushel elevator used in conjunction with the models having a new concrete elevator.

An allocation of $100 was made to sideline expense when volume was $145,000 compared to $25 when it was $30,000. The difference was due to the bulk petroleum operations. Painting of steel bulk tanks and repair and maintenance to pumping equipment account for the difference. The $25 charge was for the feed and miscellaneous farm production supply warehouse building.. (Table 11)

Considering the foregoing conditions influencing this expense and the field observations of actual operating experience, the amounts shown for the volume specified in Table 11 were believed to be accurate for the models.

The amounts shown for the total and for the grain functions will change at the rate of $10 for each increase or decrease of 100,000 bushels of grain elevator volume.

Table 11 - Repair and maintenance expense and its allocation to major operating functions at specified volume for the study models.1/

Elevator models	Sideline volume	Total annual expense	Allocated to		
			Sideline	Grain merchandising or handling	Grain storage
Old 20,000-bu.	$ 30,000	$375	$ 25	$275	$ 75
Old 20,000-bu.	145,000	450	100	275	75
New 20,000-bu.	30,000	75	25	39	11
New 20,000-bu.	145,000	150	100	39	11
New 100,000-bu.	30,000	375	25	262	88
New 100,000-bu.	145,000	450	100	262	88
New 200,000-bu.	30,000	425	25	292	108
New 200,000-bu.	145,000	500	100	292	108
New 300,000-bu.	30,000	475	25	320	130
New 300,000-bu.	145,000	550	100	320	130
New 600,000-bu.	145,000	900	100	369	231

1/ Grain volume merchandised or handled was 130,000 bu. for the 20,000-bu. elevator and 2 times rated capacity of the new concrete elevator. Maximum storage capacity used was 15,000 bu. in the 20,000-bu. elevators and 90 percent of rated capacity in each model of the new concrete elevators.

Allocation to the grain function was made on the same percentage as shown in Table 1 for valuation of elevator building and equipment, except that 75 percent of total elevator expense was considered equipment expense and 25 percent building expense.

Auditing Expense

The auditor's expense for travel, preparing and typing one audit statement per year, preparing the tax returns, and other similar duties was about the same for a 20,000-bushel elevator operation as for those of larger sizes. Since the study assumed good management and comparable employees for their respective job responsibilities, bookkeeping practices were also considered good. Therefore the principal variable in auditing expense was the time necessary for the auditor to check posting entries, bank statements, and other such items that varied directly with volume.

Allocation to the three major operating functions was made on the basis that grain merchandising or handling was the primary function. Therefore the sideline and grain storage functions were charged only for the portion of the auditor's time devoted to checking entries for these functions and setting up any special audit schedules shown for these specific functions. On that basis a charge of $20 was made when sideline volume in the models was $30,000 and $50 when it was $145,000. (Table 12)

Allocations to the two grain functions were made on the same percentage basis used to allocate manager and bookkeeper salaries.

From the costs by functions shown in Table 12 for the grain volumes specified, costs for the grain functions change at a rate of $25 for each change of 100,000 bushels merchandised or handled.

Table 12 - Auditing expense for the models at specified volume for the three operating functions. 1/

Elevator models	Sideline Volume	Total	Allocated to: Sideline	Grain merchandising or handling	Grain storage
Old or new 20,000-bu.	$ 30,000	$170	$20	$142	$ 8
Old or new 20,000-bu.	145,000	200	50	142	8
New 100,000-bu. plus old 20,000	30,000	220	20	180	20
New 100,000-bu. plus old 20,000	145,000	250	50	180	20
New 200,000-bu. plus old 20,000	30,000	270	20	225	25
New 200,000-bu. plus old 20,000	145,000	300	50	225	25
New 300,000-bu. plus old 20,000	30,000	320	20	270	30
New 300,000-bu. plus old 20,000	145,000	350	50	270	30
New 600,000-bu. plus old 20,000	145,000	500	50	405	45

1/ Grain volume merchandised or handled was 150,000 bu. for the 20,000-bu. elevator and 2 times rated capacity of the new concrete elevators. Maximum storage capacity used was 15,000 bu. in the 20,000-bu. elevator and 90 percent of rated capacity in each models of the new concrete elevators.

Advertising

The expense items for advertising include only that done by country elevators in newspapers, magazines, posters, or on radio. Actually in 9 cases out of 10 this will all be for the sideline commodities handled. For the models used in this study, all advertising expense was for the sideline function of operations.

The amount of this expense item was arrived at from careful analysis of association journal and ledger postings which described the particular expense item. From that analysis the following amounts were thought to represent advertising expense fairly: (1) For feed and miscellaneous production supplies with annual volume of $30,000 the amount of expense was $30; (2) for an increase in volume to $145,000, to include bulk petroleum products, the amount increased to $50.

These amounts may appear low on first thought, but it should be recalled that advertising expense did not include organizational advertising or promotion activities and that it was for the feed and petroleum sideline commodities.

Donations

Elevator organizations along with other businesses in a local community are expected to support the Red Cross, Community Chest and other fund raising activities the community sponsors either formally or informally. Regardless of other considerations this participation is important to the organization from the point of view of good will; therefore this expense is rather sticky in response to volume changes.

It was assumed the 20,000-bushel elevator handling $30,000 worth of sideline commodities, merchandising or handling 50,000 bushels and storing locally as much as 15,000 bushels averaged about $100 in donations. Of this amount $10 was charged to the sideline function and the remainder of $90 to the primary function -- grain merchandising or handling. When petroleum products were added to the above and sideline volume was $145,000, the total charged to the sideline function was $25, The foregoing was the minimum annual amount donated in the study example.

Field observations and Kansas survey data indicated the amount of donations increased because of both size of plant and grain volume merchandised or handled at a rate of $20 for each increase of 100,000 bushels of grain receipts.

The study determined that, chiefly because of the storage function, size of facilities was a factor in the increase along with volume of receipts. Therefore in the larger elevators allocation was the same as has been mentioned for sidelines but the remainder allocated for the 2 grain functions was divided 75 percent to grain merchandised or handled and 25 percent to the grain storage function.

Meeting and Member Relations Expense

The item of meeting and member relations expense includes not only the small cost for the use of a building for the annual meeting, but also the cost of refreshments, printing statements, and such other strictly member and public relations expenses as special meetings, calendars, and small presents, such as pencils at Christmas time to be sent to patrons.

This item of expense increases slightly but not in direct ratio to increased numbers of patrons and sales in the larger associations. The amounts listed in Table 13 appear to be about right, based on field observations and Kansas survey data.

Table 13 - Meeting and member relations expense for the models at specified volume for the three operating functions.1/

Elevator models	Sideline Volume	Total expense	Allocated to: Sideline	Merchandising or handling	Storage
Old or new 20,000-bu.	$ 30,000	$150	$10	$135	$5
Old or new 20,000-bu.	145,000	180	40	135	5
New 100,000-bu. plus old 20,000	30,000	160	10	135	15
New 100,000-bu. plus old 20,000	145,000	190	40	135	15
New 200,000-bu. plus old 20,000	30,000	180	10	153	17
New 200,000-bu. plus old 20,000	145,000	210	40	153	17
New 300,000-bu. plus old 20,000	30,000	200	10	171	19
New 300,000-bu. plus old 20,000	145,000	230	40	171	19
New 600,000-bu. plus old 20,000	145,000	290	40	225	25

1/ Grain volume merchandised or handled was 150,000 bu. for the 20,000-bu. elevator and 2 times rated capacity of the new concrete elevators. Maximum storage capacity used was 15,000 bu. in the 20,000-bu. elevator and 90 percent of rated capacity in each models of the new concrete elevators.

Ten dollars of meeting and member relations expense was allocated to sidelines when volume was $30,000 and $40 when it was $145,000 annually. Allocation of the remainder to the grain functions was on the same percentage basis as manager and bookkeeper salaries. The amount of the allocation to the grain functions changes at a rate of $10 for each 10,000 bushels in grain volume merchandised and handled.

Subscriptions and Dues

One expense item includes subscriptions to trade publications, credit service, market services, daily and weekly newspapers. It also includes dues to various organizations such as farm organizations, the local Chamber of Commerce, Lions or Rotary Clubs, or other similar organizations.

Most of this expense should be charged to the primary operation -- grain merchandising or handling -- with only what can be directly attributed to sidelines so charged. This expense, like that of advertising, will be slightly higher with the larger volume associations. Since some magazines are taken because of sideline operations $10 of the total was charged to feed operations and $20 to feed and petroleum. The remainder was all charged to the primary function -- grain merchandising or handling -- as none of this expense was incurred directly for the grain storage fucntion.

Beginning with 100,000-bushel volume this expense item increased at a rate of $3 per 100,000-bushel increase in volume merchandised or handled and the increase was all chargeable to that function. (Table 14)

Table 14 - Dues and subscriptions expense for the models at specified volume for the three operating functions. 1/

Elevator models	Sideline Volume	Total expense	Allocated to: 2/ Sideline	Allocated to: 2/ Grain merchandising or handling
Old or new 20,000	$ 30,000	$40	$10	$31
Old or new 20,000	145,000	50	20	31
New 100,000-bu. plus old 20,000	30,000	43	10	33
New 100,000-bu. plus old 20,000	145,000	53	20	33
New 200,000-bu. plus old 20,000	30,000	49	10	39
New 200,000-bu. plus old 20,000	145,000	59	20	39
New 300,000-bu. plus old 20,000	30,000	55	10	45
New 300,000-bu. plus old 20,000	145,000	65	20	45
New 600,000-bu. plus old 20,000	145,000	80	20	60

1/ Grain volume merchandised or handled was 150,000 bu. for the 20,000-bu. elevator and 2 times rated capacity of the new concrete elevators. Maximum storage cpacity used was 15,000 bu. in the 20,000-bu. elevator and 90 percent of rated capacity in each of the models of the new concrete elevators.

2/ No allocation to storage.

Legal Expense

Legal expense is usually a small item as indicated by data on all Kansas co-op elevators. It is an item that remains fairly fixed but will be slightly higher with larger volume of grain and sidelines. Most of the legal expense is associated with organization papers, and as grain merchandising is the main function it was charged with all but $10, and $20, respectively, which was allocated to the small and the large sideline volume models -- feed and petroleum. A charge was made of $2 for each 100,000-bu. volume increase. Except for charging the increase of each 100,000-bushel in volume at $2 rather than $3, this expense and its allocation was treated like that just shown for dues and subscriptions in Table 14.

Directors' Fees

For the models the expense item of directors' fees did not change with changes in volume. In that sense it was a fixed expense. However, fees are subject to change at any time by the directors themselves. Usually if an increase is proposed it is done with approval of members. So from that point of view there fees are an expense that is slow or sticky in response to volume change.

In this study five directors were each allowed $5 per monthly board meeting attended to cover travel and miscellaneous out-of-pocket expenses. Average attendance amounted to an average annual cost of $240.

Allocation to sidelines was $20 when volume was $30,000 and $40 when it was $145,000 to compensate for the estimated time spent on these commodities. The remainder was allocated to the grain functions on the same basis as manager and bookkeeper salaries.

Travel

Travel in each case was to the annual meeting of the regional grain and farm supply cooperative and to district trade meetings. Travel expense was not allowed for use of manager's car in the local trade territory, except occasionally on collection trips. Travel in connection with organizational matters was charged to grain merchandising as that is the mainline operations of the association. For the purposes mentioned travel varied only to a limited degree because of special collections trips -- a sideline function. For the sideline function the charge was $25 for the $30,000 sideline volume and $50 when annual volume was $145,000.

Bad Debts

Bad debts are entirely a result of credit extended on sales of the sideline commodities handled. As such they are chargeable only to the sideline operating function. For the models used these costs were $20 annually when sideline volume was $30,000 annually and $70 when it was $145,000.

Summary of Slow or Sticky Expenses

Table 15 summarizes all expenses under the classification of slow or sticky expenses.

Table 15 - Summary of slow or sticky costs and their allocation to major operating functions at specified volume for models. 1/

Elevator models	Total slow or sticky costs	Allocation of slow or sticky costs to: Sidelines	Grain merchandising or handling	Grain storage
Sideline volume $30,000				
Old 20,000	$1,852	$218	$1,506	$128
New 20,000	1,562	218	1,271	73
New 100,000-bu. plus old 20,000	2,176	218	1,598	360
New 200,000-bu. plus old 20,000	2,800	218	2,033	549
New 300,000-bu. plus old 20,000	3,373	218	2,479	676
Sideline volume $145,000				
Old 20,000	2,156	544	1,486	126
New 20,000	1,866	544	1,251	71
New 100,000-bu. plus old 20,000	2,480	544	1,578	358
New 200,000-bu. plus old 20,000	3,104	544	2,013	547
New 300,000-bu. plus old 20,000	3,677	544	2,459	674
New 600,000-bu. plus old 20,000	5,089	544	3,512	1,033

1/ Grain volume merchandised or handled was 150,000-bu. for the 20,000-bu. elevator models and 2 times new concrete elevator capacity for the other models. Maximum storage capacity used was 15,000 bu. for the 20,000-bu. elevator models and 90 percent of new concrete elevator capacity for the rest of the models.

Other Variable Expenses

The group of operating expenses that vary directly with volume are called variable expenses. They react much more directly to volume change than the preceding groups -- personnel expenses and slow or sticky expenses.

Expenses included in this group are: Insurance on grain and sideline stocks, operating expenses for the bulk petroleum trucks, office supplies, plant supplies, fumigants, and interest on borrowed seasonal capital.

Insurance on Stocks

Insurance rates on grain stocks were the same as those previously discussed for buildings and equipment -- $0.16, $1.00 and $1.40 per $100 of coverage respectively, on the concrete and the new and the old wood iron-clad elevators. Insurance firms calculate annual premium adjustments on grain stocks from weekly grain stock reports. Therefore, as the elevator association reports weekly on storage and owned inventory stocks the insurance company adjusts its coverage to the stock report. At the end of the year the prepaid premium is adjusted for the actual coverage based on weekly reports.

Insurance on sideline stocks was calculated at $1.40 per $100 valuation for warehouse and $1.80 for bulk petroleum stocks. Feed, seed and miscellaneous farm supply stock averaged about $4,000. Oil stocks valuation in the warehouse averaged another $1,000. Therefore insurance costs for warehouse stocks including oil was $70. Average valuation of bulk petroleum stocks was $3,000. Thus annual cost for bulk petroleum stocks was $54.

In the examples of the 20,000-bushel old or new elevator, inventory stocks had an average value of $5,000 when volume of all grain merchandised or handled was 150,000 bushels annually. At this volume, insurance on owned inventory was $70 in the old elevator and $50 in the new elevator. In the model using a new concrete elevator and the old 20,000-bushel elevator, one-half the value of inventory was considered to be in each elevator. That is, about $2,500 worth of feed grains, including milo was calculated for the old elevator, and the wheat inventory, averaging the same value was calculated for the concrete elevator.

This situation existed when annual volume merchandised or handled was 150,000 bushels. As size of plant increased from the 20,000-bushel elevator, average inventory valuations increased $1,000 for each increase of 100,000 bushels of new elevator capacity. Thus, in the model of the new 100,000-bu. concrete elevator plus the old 20,000-bushel elevator, inventory insurance cost was $35 for stocks in the old elevator, plus $4 for those in the new elevator, plus $3 for the additional $1,000 of inventory due to the larger capacity and bins of the new 100,000-bushel elevator and the additional 50,000-bushel volume -- making a total of $42. (Table 16)

As suggested, the amount of average owned inventory values also changedat a rate of $1,000 in valuation for each change of 100,000 bushels in volume merchandised or handled. So plant size and volume changes together resulted in about $3 more insurance cost for the new 100,000-bushel concrete elevator than for the 20,000-bushel elevator because of the influence of size and an additional 50,000 bushels of grain merchandised or handled. This was calculated on the 16-cent rate for the new concrete elevator. When only the 20,000-bushel elevator was used, any increase in inventory was in that elevator and was figured at either $1.00 or $1.40 per $100 of valuation, depending on whether it was the old or the new elevator model.

Insurance on storage stocks carried the same rates per $100 of valuation as did owned inventory stocks -- $0.16 for stocks in the concrete elevator and $1.40 and $1.00 respectively for the old and the new 20,000-bushel elevators. In the models having a new concrete elevator, storage stocks were always carried in that elevator except when all possible available local space was needed. In that case as much as 15,000 bushels was stored temporarily in the old 20,000-bushel elevator. In that situation the average volume with period of storage was 10,000 bushels for 2 months in the old elevator -- until storage sales made available necessary space in the concrete elevator.

The grain stored for farmers was wheat and it was figured at $2.25 per bushel for calculating insurance valuation. For the full storage year all storage stocks averaged 60 percent of the maximum number of bushels stored at any time during the year. This amount is low during any year that most farmers obtain a Government loan and do not redeem it. On the other hand, the amount is on the high side when the C.C.C. loan is not a factor influencing the length of the average period farmers in the hard winter wheat belt store in country elevators.

Table 16 - Insurance expense on stocks for the models at specified volume for each of the three operating functions.

Elevator models	Total expense	Allocated to: Sidelines[1]	Grain merchandising or handling[2]	Grain storage[3]
Old 20,000-bu.	$ 668	$124	$70	$ 474
New 20,000-bu.	513	124	50	339
New 100,000-bu. plus old 20,000	413	124	42	247
New 200,000-bu. plus old 20,000	611	124	45	442
New 300,000-bu. plus old 20,000	808	124	48	636
New 600,000-bu. plus old 20,000	1,401	124	58	1,219

[1] Sideline volume in each model was $145,000 annually, When it was $30,000, insurance on stocks cost $56 annually instead of $124. Total expense was $68 less than the amounts shown.

[2] Volume was 150,000 bushels annually in the 20,000-bu. elevator models and 2 times new concrete elevator capacity in models of a concrete elevator.

[3] Maximum storage capacity used was 15,000 bu. in models of an old or a new 20,000-bu. elevator. When a concrete elevator was a part of the plant model maximum storage was 90 percent of new elevator capacity.

Delivery Truck Expense

This item includes gas, oil, licenses, tires, repairs and maintenance expenses for the two trucks used to make farm deliveries of bulk petroleum products. Fixed costs of insurance, taxes and depreciation on the trucks were not included in this item. The annual cost was $1,650.[1] This was entirely a sideline expense for those models in which petroleum products are handled.

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[1] Mather, J. W., Performance Standards for Tank Truck Salesmen of CCA Local, FCA Misc. Rpt. #166, May 1952

Office Supplies

This item of expense includes postage, all bookkeeping and accounting supplies, stationery, machine service and miscellaneous office supplies. Field study observations, including data on the relative number of bookkeeping transactions for the three operating functions, together with the Kansas survey data, were used as a guide in determining the amount and functional allocation of this expense for the different models.

An analysis of actual bookkeeping transactions per unit or dollar volume indicated a high ratio of sideline to grain. A scale ticket is made for each load of grain. These tickets showed that two-thirds of the truck loads of grain were more than 100 bushels per load and were worth more than $225 per load.

The average load of grain has more than 10 times as much dollar value as the average sideline sale. Furthermore several loads of grain from one patron may constitute a purchase of grain from that patron which in turn is entered in the proper journal and ledger accounts on the same basis as a sale of a $5 sack of feed. Extra bookkeeping entries are made for credit sales of sideline commodities.

As has been the policy on other expense items, office supplies used for organizational purposes or those that would have occured if grain merchandising or handling had been the only operating function, were charged to merchandising or handling as the primary operating function.

All things considered office supply expenses were set up in the study examples as follows:

1. Seventy-five dollars was allocated to sidelines where annual volume was $30,000.

2. When bulk petroleum products were added and volume increased to $145,000 the allocation was $170.

3. With the first 100,000 bushels of grain receipts allocation was $45.

4. With each additional 100,000 bushels of receipts allocation to the two grain functions increased by $30.

5. Allocation to the two grain functions was on the same percentage basis as the salaries of the manager and bookkeeper.

Plant Supply Expense

Included in plant supplies are oil and grease for machinery, brooms and shovels used for cleaning, rodent control materials, refill for fire extinguishers, tags, and sacks or other containers. The fumigant used to control insects is also usually considered a plant supply but, because of the different method of allocation it was shown as a separate expense item.

Plant supplies for sidelines were estimated at $30 and $50 for the respective sideline volume used in the models -- $30,000 and $145,000 annually.

Forty dollars was allocated for the first 100,000 bushels of grain receipts annually. From that point an additional $10 was allocated with each increase of 100,000 bushels.

Allocation of supply costs to the two grain functions was made on the percentage basis shown in Table 1 for elevator machinery and equipment.

Fumigant

Elevators that do not store treat grain received for merchandising when it contains live weevils.

The extent of the treatment for grain insects and costs of the fumigant used in the study models were based on an average crop condition as it related to weevil infestation. Thirty dollars was allocated to the primary grain function for treating owned stocks in the old or the new 20,000-bushel elevator when volume merchandised or handled was 100,000 bushels. At this volume, when the model was a new concrete elevator plus an old 20,000-bushel elevator, the charge on the first 100,000 bushels merchandised or handled was $45.

Above 100,000 bushels the charge to merchandising or handling was an additional $15 for each addition to volume of 100,000 bushels. This included treating bin walls once a year in the old elevator and treating about 8,000 bushels of grain at the rate of $1.80 per 1,000 bushels. It included treating only 8 percent of annual volume merchandised or handled. This amount may appear low but it was believed fair considering the fact that about one-half of the volume was received and merchandised directly from the combine, and live weevils were not a problem.

Storage stocks are treated as needed when they are being turned. Considering that stocks average for the year only 60 percent of the maximum capacity used and also considering the condition of the crop; prudent management would be likely to use an amount of fumigant equal to that required to treat the maximum number of bushels stored at any time during the year. This may mean that some bins are treated 2 or 3 times during the year, others may not be treated at all, especially if the stocks are in storage only 2 or 3 months.

Cost of treating storage stocks in the models was $1.80 per 1,000 bushels used, except in wood 20,000-bushel elevators where it was $3 per 1,000 bushels.

Interest on Borrowed Seasonal Capital

Interest on all capital used is separated into interest on borrowed capital for seasonal use and interest on deferred liability and member equity capital. The latter kind of capital is that needed to own fixed assets and to provide the working capital used continuously during the year.

Seasonal capital requirements are usually provided by establishing a commitment for operating capital which can be drawn on as needed seasonally. When not needed it is repaid into the general capital fund. Seasonal capital is strictly a variable expense, whereas the regular capital requirements tend to be fixed. Seasonal capital usually is obtained at a slightly lower interest rate than that paid for long-term borrowed capital used for normal year-round capital needs.

For this study, the foregoing classification of capital is better from the standpoint of accurately budgeting this expense to the operating functions. Management practices assumed for the models include a sound credit policy on sidelines. Grain also is sold promptly when a carlot is purchased. Drafts are drawn when the car is loaded and the bill of lading made out. So working capital requirements reflect good management practices that result in relatively low amounts used in relation to volume.

The amounts and costs of seasonal capital used are shown in Table 17. Methods of calculating costs are explained in the table notes.

Table 17 - Borrowed seasonal operating capital and its cost by operating functions at special volume for each of the three operating functions.

Elevator models	Maximum capital used by functions				Cost at 3-1/2 percent by functions		
	Sidelines 1/	Grain merchandised or handled 2/	Grain storage 3/	Total	Sidelines	Grain merchandised or handled	Grain storage
Old or new 20,000-bu.	$2,000	$1,500	$ 375	$3,875	$12	$ 9	$ 4
New 100,000-bu. plus old 20,000-bu.	2,000	2,000	2,250	4,250	12	12	26
New 200,000-bu. plus old 20,000-bu.	2,000	4,000	4,500	10,500	12	23	53
New 300,000-bu. plus old 20,000-bu.	2,000	6,000	6,750	14,750	12	35	79
New 600,000-bu.	2,000	9,000	13,500	24,750	12	53	157

1/ Sideline volume shown here was $145,000 annually. Petroleum products require an average of about $2,000 seasonal capital for 2 months to assure being able to take cash discounts on purchases. Seasonal capital was not borrowed for the sideline function when volume was $30,000 annually.

2/ Annual volume was 150,000-bu. for the 20,000-bu. elevator models and 2 times rated capacity of the new concrete elevators. Costs were figured at 3.5 percent for 2 months on maximum amounts used.

3/ Maximum storage capacity used was 15,000-bu. for the 20,000-bu. elevator models and 90 percent of rated capacity of the new concrete elevators. Seasonal capital is not borrowed for this function when storage charges can be collected at the end of the storage period. However, the model shows the situation experienced where handling and storage charges are to be collections from C.C.C. In this case seasonal capital needs were calculated at 5 cents per bushel on one-half maximum capacity used for an average of 4 months. Interest rate was 3-1/2 percent.

Summary of Other Variable Expenses

Table 18 summarizes all variable expenses -- insurance on stocks, delivery truck expense, office supplies, plant supplies, fumigants, and interest on borrowed seasonal capital.

Table 18 - Summary of variable expenses and their allocation to major operating functions at specified volume for the study models.

Elevator models	Total variable expenses	Allocation of variable expenses to		
		Sidelines[1]	Grain merchandising or handling[2]	Grain storage[3]
Old 20,000-bu.	$2,759	$2,008	$213[4]	$ 538[4]
New 20,000-bu.	2,540	2,008	193[4]	339[4]
New 100,000-bu. plus old 20,000	2,637	2,008	227[4]	402[4]
New 200,000-bu. plus old 20,000	3,151	2,008	345	798
New 300,000-bu. plus old 20,000	3,664	2,008	466	1,190
New 600,000-bu. plus old 20,000	5,188	2,008	785	2,395

[1] Sideline volume was $145,000. Expenses included $1,650 for operating costs on 2 petroleum trucks. When volume was $30,000 annually variable sideline expenses dropped to $161 annually.

[2] Annual volume was 150,000 bu. for the 20,000-bu. elevator models and 2 times new concrete elevator capacity for the other models.

[3] Maximum storage capacity used was 15,000 bu. for the 20,000-bu. elevator models, and 90 percent of new concrete elevator capacity for the rest of the models.

[4] Difference in cost of insurance on owned and storage stocks accounted for the relatively high variable cost of the 2 grain functions in models for the 20,000-bu. elevators. The old 20,000-bu. elevator was not used for storage when operated in conjunction with the new concrete elevator models at the volume level shown in this table.

Non-Operating Statement Expenses

For this study three other cost items should be included. They are: Interest on deferred liability and member equity capital, shrinkage, and quality deterioration. They are not listed last because they are considered least important. Rather, they are separated from the other expense groups for emphasis and to be sure their influence on total costs by functions is evident to those studying the analysis and the resulting costs shown for the elevator models. Still another reason is that they are not listed as expenses in actual elevator operating expense statments or audits. Therefore, to include them with fixed, slow or other variable expenses might be misleading or confusing to those used to considering total cost as only those items listed in elevator operating statements.

Interest on Deferred Liability and Member Equity Capital

Under the discussion of variable expenses and of the expense of interest on borrowed seasonal capital, an explanation was given for separating, for purposes of determining interest costs, on all capital used into two items - (1) deferred liability and member equity capital and (2) borrowed seasonal capital. Together these two constitute all capital used.

Interest on deferred liability and member equity is on capital needed regularly throughout all the year. It has many of the characterisitcs of a fixed expense. Interest paid on a deferred liability is shown in elevator operating expense statements. However, interest on member equity capital used continuously throughout the year is shown either as stock dividends, or in some cases, interest is not paid at all as in the case of surplus, reserves, and some other forms of member capital. The relative amounts of member equity capital on which interest is paid varies considerably from one elevator association to another.

Therefore in order to maintain interest costs in the models on an entirely comparable basis, interest was figured as a cost on surplus and reserves as well as on all other member equity capital and long-time borrowed capital.

Four percent interest was calculated on the amounts of this capital being used in each model and shown in Table 19.

Table 19 - Deferred liability and member equity capital used by operating functions and its cost.[1]

Elevator model capacities	Sideline volume	Capital used by function						Total	Cost at 4 percent interest by functions		
		Sidelines [1]		Grain merchandising or handling [1]		Grain Storage [1]					
		Plant [2]	Working capital	Plant [2]	Working capital	Plant [2]	Working capital		Sidelines	Grain merchandising or handling	Grain Storage
Old 20,000-bu.	$ 30,000	$ 4,000	$ 5,000	$12,100	$5,000	$ 900	None	$ 27,000	$ 360	$ 684	$ 36
	145,000	20,000	15,000	12,100	5,000	900	"	48,000	1,400	684	36
New 20,000-bu.	30,000	4,000	5,000	22,979	5,000	7,236	"	44,215	360	1,119	289
	145,000	20,000	15,000	22,979	5,000	7,236	"	70,215	1,400	1,119	289
New 100,000-bu. plus old 20,000-bu.	30,000	4,000	5,000	56,850	5,500	46,150	"	117,500	360	2,494	1,846
	145,000	20,000	15,000	56,850	5,500	46,150	"	143,500	1,400	2,494	1,846
New 200,000-bu. plus old 20,000-bu.	30,000	4,000	5,000	67,300	6,000	81,700	"	164,000	360	2,932	3,268
	145,000	20,000	15,000	67,300	6,000	81,700	"	190,000	1,400	2,932	3,268
New 300,000-bu. plus old 20,000-bu.	30,000	4,000	5,000	76,100	7,500	116,900	"	209,500	360	3,344	4,676
	145,000	20,000	15,000	76,100	7,500	116,900	"	235,500	1,400	3,344	4,676
New 600,000-bu. plus old 20,000-bu.	145,000	20,000	15,000	96,260	9,000	208,740	"	349,000	1,400	4,170	8,350

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[1] The amounts of capital shown by functions were believed to be adequate for minimum requirements or capital that was needed continuously throughout the marketing year. It did not take into account seasonal needs considered under the heading Borrowed Seasonal Capital.

[2] For detail on plant valuation or costs included in this function see table 2. Note — Office buildings and equipment are investments included in the grain merchandising or handling function. Also investment in the old 20,000-bu. elevator was included in all models using a new concrete elevator.

Shrinkage

In most elevator operating statements, shrinkage influences net operating results but is not shown as a cost item. Actually its influence is in fewer units sold and in lower gross margins by the amount of the shrinkage. Sometimes an elevator audit will have a commodity statement schedule which shows shrinkage, but even then it is not shown in the operating statement as a separate cost item.

Shrinkage was handled as a separate cost item in this study to show its specific influence on operating costs and to avoid confusion that might result by including it in the variable expense group where, because of practice, it is not expected to be found. Actual records on loss of weight on grain during the merchandising or handling and storage functions of a country elevator are not very satisfactory. Even where records are accurate in showing the loss for a particular year's operation, there is still the question of accurate data on the particular weighing and dockage policy followed.

However, from the general information available and from specific existing records a weight and grain loss of one-fourth of 1 percent in handling or merchandising appears reasonable under good management. An additional figure of one-fourth of 1 percent for this loss during storage is used. At $2.25 per bushel this amount is a little over one-half cent in each case. As used in this study it was a fixed rate of fifty-six one-hundredths of a cent on each bushel merchandised or handled and the same amount on each bushel of storage capacity used.

Feed, seed and miscellaneous farm production supplies constituting the $30,000 sideline volume models were not charged with shrinkage. It was assumed that the warehouse building was adequate and that the control of mice and rats was reasonably good.

Shrinkage of 1.5 percent was charged on the $115,000 of petroleum sales. That is about the average percentage experienced on all petroleum products in the hard winter wheat area.

Quality Deterioration

Loss of quality on commodities sold as compared to purchases is, like shrinkage, an influence that lowers gross margins in practically all elevator operating statements. However, loss of quality is less apparent in those statements than other losses because it is practically never shown in a supporting schedule to the operating statement.

Management assumes more risk from its responsibility for grain quality maintenance, particularly in storage stocks, than from any other single cost factor affecting operating results. At present prices for wheat loss of quality can conceivably break an elevator organization in a single year, when volume stored locally is 100,000 bushels or more and when quality deteriorates to the point that grain is unfit for human consumption.

On the other hand, prudent elevator management may actually improve the grade of grain while it is in their elevator. Moisture content may be lowered, test weight per bushel may be improved, and foreign material or other grain may be removed.

Quality deterioration on a net basis was considered separately and was labeled a cost in each model of elevator operations for the same reasons mentioned under the discussion of shrinkage.

Of the 9 cases studied intensively 5 had net losses in quality. A comparison of in-grades and official out-grades showed that losses were .9 of a cent to 9.5 cents per bushel on the volume of grain merchandised or handled. This indicated that per bushel quality deterioration loss on storage stocks may have been considerably higher. One association had the same in-grades and out-grades and three had gains in grades that amounted to more than 1 cent per bushel. As mentioned previously, local records were not sufficient to determine how much of the loss was due to grading practices and how much to quality deterioration in the elevator. However, differences of more than 1 cent in value between in-grades and out-grades can rarely be traced to grading practices. In most cases, examination of out-grades in a few carlots clearly showed a large loss of quality, which indicated rather severe quality deterioration in at least a part of storage stocks.

As has been pointed out, management assumed for the respective models was good, considering their respective salary levels and their responsibilities. Field checks on in-grades and out-grades indicated a poorer performance in the small elevator. The salary level was lower. Apparently management in the small elevator tended to overgrade receipts as a means of obtaining volume or they were less prudent in their care of storage stocks.

The study models of 100,000-bushel capacity or more were assumed to have maintained grain quality. For the 20,000-bushel elevator models loss of quality between in-grades and out-grades was calculated at three-tenths of a cent on each bushel merchandised or handled and five-tenths of a cent on each bushel of storage capacity used.

Summary of All Expenses at a Specified Volume

Table 20 summarizes all expenses of the study models. The summary is for the volume specified during the foregoing discussions of the individual expense items.

Table 20 - Total costs by the three major operating functions of elevator model operations at specified volume levels. 1/

Expense groups	Annual sideline volume		Allocated to grain merchandising or handling by size of elevator						Allocated to grain storage by size of elevator					
	$30,000	$145,000	Old 20,000-bu. elev.	New 20,000-bu. elev.	New 100,000-bu. elev. 2/	New 200,000-bu. elev. 2/	New 300,000-bu. elev. 2/	New 600,000-bu. elev. 2/	Old 20,000-bu. elev.	New 20,000-bu. elev.	New 100,000-bu. elev. 2/	New 200,000-bu. elev. 2/	New 300,000-bu. elev. 2/	New 600,000-bu. elev. 2/
Regular operating statement expenses														
1. Fixed	$ 300	$ 1,491	$1,491	$2,305	$ 4,780	$ 5,640	$ 6,379	$ 7,895	$ 171	$ 606	$2,765	$4,521	$6,235	$11,773
2. Salaries and wages	1,750	8,751	3,660 3/	3,660 3/	4,131 3/	6,597 3/	8,106 3/	12,238	252	252	710	854	1,024	1,220
3. Slow or sticky 4/	218	544	1,486	1,251	1,578	2,013	2,459	3,512	126	71	358	547	674	1,033
4. Variable	161	2,008	213	193	227	345	466	785	538	339	402	798	1,190	2,395
Sub-total	$ 2,429	$12,794	$6,850	$7,409	$10,716	$14,595	$17,410	$24,430	$ 1,087	$ 1,268	$4,235	$6,720	$9,123	$16,421
Other expenses														
1. Interest on capital used regularly	$ 360	$ 1,400	$ 684	$1,119	$ 2,494	$ 2,932	$ 3,344	$ 4,170	$ 36	$ 289	$1,846	$3,268	$4,676	$ 8,350
2. Shrinkage and quality loss	None	1,725 5/	1,294	1,294	1,125	2,250	3,375	6,750	159	159	506	1,013	1,519	3,036
Sub-total	$ 360	$ 3,125	$1,978	$2,413	$ 3,619	$ 5,182	$ 6,719	$10,920	$ 195	$ 448	$2,352	$ 4,281	$ 6,195	$11,386
Totals	$ 2,789	$15,919	$8,828	$9,822	$14,335	$19,777	$24,129	$35,350	$ 1,282	$ 1,716	$6,587	$11,001	$15,318	$27,087

1/ Grain volume merchandised or handled was 150,000 bu. annually for the 20,000-bu. elevator models and three times new elevator capacity for the new concrete elevator models; maximum storage capacity used was 15,000 bu. in the 20,000-bu. elevator models and 90 percent of the new concrete elevator capacity for the other study models.

2/ Includes an old 20,000-bu. elevator operated in conjunction with the new concrete elevator.

3/ Costs for the two grain functions were calculated on the basis that sideline volume was $145,000; when it was $30,000 they were $515 more than those shown. Grain merchandising or handling salary costs were $515 less.

4/ These expense allocations for sideline volume of $145,000 to grain merchandising or handling were about $20 more than those shown when sideline volume was $30,000 chiefly because of allocation of directors' fees.

5/ This is shrinkage on petroleum products figured at 1.5 cents per dollar of sales.

EXPENSE GROUP RESPONSE TO DIFFERENT VOLUME LEVELS

The variation due to changes in volume levels of the individual items of expense has been explained under the heading, "Budgeting Procedure". Therefore, the discussion here will be limited to a summary by the five groups under which expense items have been discussed. The influence of differences in levels of volume anticipated at a building location will be shown for each expense group by the three operating functions.

Fixed Expenses

The fixed expenses are: Depreciation, insurance and taxes on buildings and equipment, railroad lease, and bonds and licenses. The total of these expenses is normally the same from one year to the next without regard to variations that may occur in the annual unit of volume of the three operation functions. Therefore, since the amount is fixed, cost per unit of volume varies inversely with volume -- high for a relatively small annual volume and lower when volume becomes larger.

Interest on all capital invested in land facilities and equipment is also a fixed expense. It is included under other expenses in order to make the expense groupings more nearly conform with those used in practice by country elevators in the hard winter wheat belt.

Table 4, page 22, shows the amounts of these expenses for each of the three operating functions of the elevator models.

Personnel Expenses

In addition to salaries, wages and commissions of all employees, personnel expenses also include workmen's compensation, insurance, and social security costs.

Unlike fixed expenses the amounts of personnel expenses do change with different amounts of volume. The so-called regular employee salaries are more resistant to volume changes that cannot be anticipated a few months ahead. Changes due to such factors as weather, insects, or crop disease influence much more directly the amount of part-time employee wages or extra harvest season labor expense. On the other hand, regular employee compensation changes with the general level of annual volume, because of such factors as size of trade territory, the general success of member and public relation activities, and responsibility for different size plants and plant investment.

Also the more extreme changes of volume levels, particularly on the low side, are not usually followed directly by relative changes in employee compensation. For example, a manager operating a 600,000-bushel elevator will have a higher minimum compensation allocated to the grain merchandising or handling function, at a 300,000-bushel volume, than a manager of a 200,000-bushel elevator, that also merchandises and handles 300,000 bushels. Thus regular employee compensation is much more sticky when responding to volume levels that are low in relation to plant size.

The conditions just described largely explain the differences in amounts of personnel expenses for the elevator models and volume situations shown in Tables 21 and 22.

From a functional viewpoint there is one other important point to be considered in understanding data in Tables 21 and 22. It is the cost allocation formula. That formula considers grain merchandising and handling as the primary operating function and grain storage as secondary. As such, only those personnel expenses representing actual working time are charged to the grain storage function. The primary function -- grain merchandising or handling -- is charged with actual working time and with all idle time. As the primary function is charged with idle time it is much more responsive to variation in volume than is the grain storage function.

For that reason the amount of personnel expenses for the grain merchandising or handling function is accurately represented by Figure 5. In contrast, the same relationship in a chart of the storage function would result in an oblique line that is almost straight.

Table 21 - Personnel expense for the grain merchandising or handling function in the study models under various volume situations.1/

Annual bushels merchandised or handled	Personnel expense for elevator models: Old or new 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
100,000	$3,433	$3,654	$4,148	--	--
150,000	3,660	3,882	4,256	$4,843	--
200,000	3,889	4,131	4,359	4,936	--
250,0003/	5,358	5,546	5,707	6,182	--
300,000	--	5,858	6,073	6,331	$ 7,022
400,000	--	6,154	6,597	6,856	7,321
500,000 4/	--	--	7,395	7,580	7,821
600,000	--	--	7,957	8,106	8,119
900,0005/	--	--	--	11,635	11,678
1,200,000	--	--	--	--	12,770
1,500,000	--	--	--	--	13,963

1/ Sideline volume is $145,000 annually. When sideline volume is $30,000, personnel expense for the grain merchandising and handling function is about $515 higher than that shown.

2/ This model includes, in addition, an old 20,000-bu. elevator.

3/ Half-time bookkeeper added at $1,400 annually.

4/ Full-time bookkeeper added at $2,200 annually.

5/ Second full-time elevator man added at $2,600 annually.

Note - See Table 20 for the sideline function expenses.

FIGURE 5

RELATION OF PERSONNEL EXPENSE TO VOLUME OF GRAIN MERCHANDIZED OR HANDLED, BY SIZE OF ELEVATOR

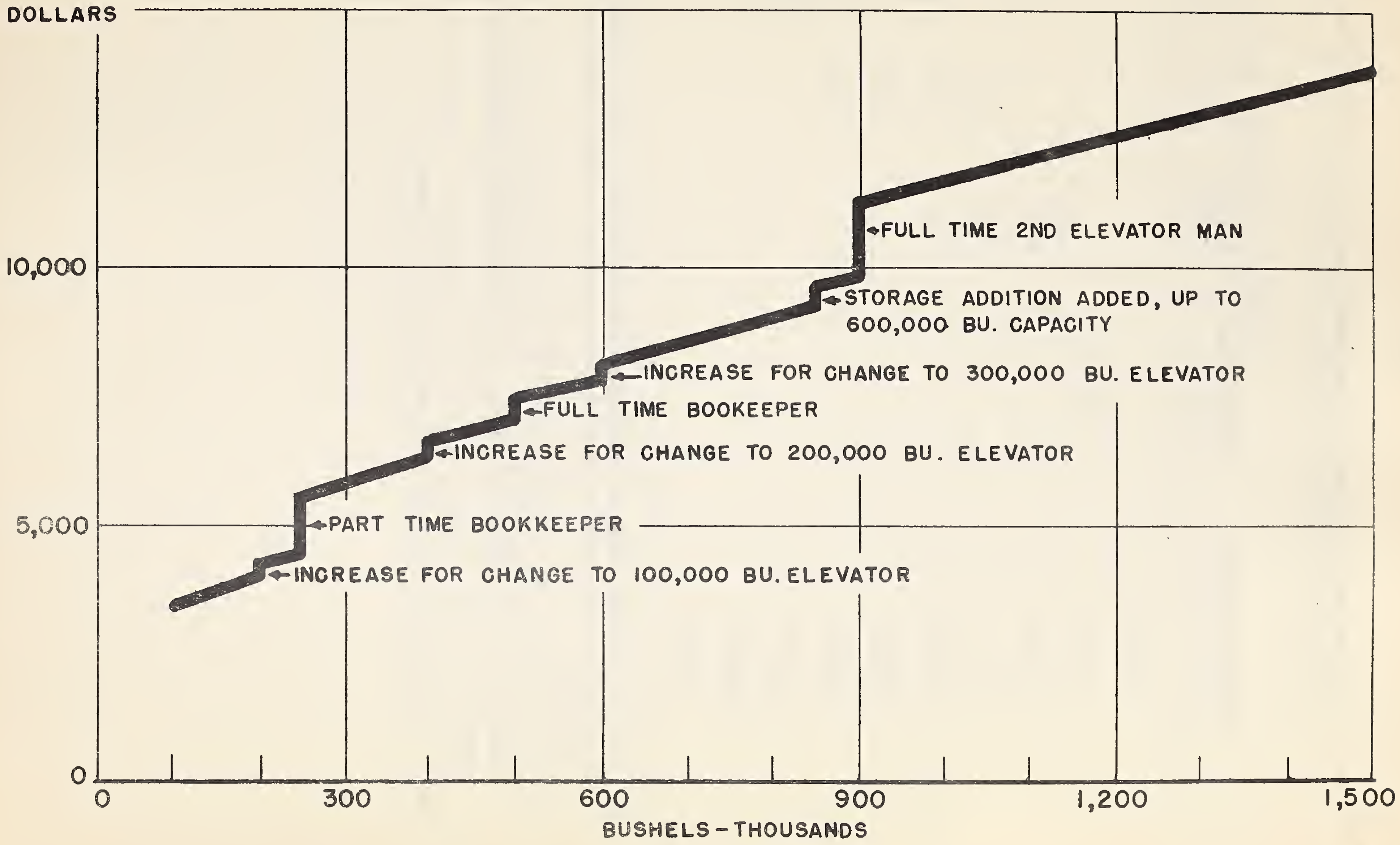


Table 22 - Personnel expenses for the grain storage function in the study models under various volume situations. 1/

Maximum storage capacity used	Personnel expense for elevator models				
	Old or new 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
(Bushels)					
15,000	$252	-	-	-	-
30,000	-	$679	-	-	-
60,000	-	695	$788	-	-
90,000	-	710	798	$847	-
120,000	-	-	808	879	-
180,000	-	-	854	911	$ 932
270,000	-	-	-	1,024	1,034
360,000	-	-	-	-	1,076
540,000	-	-	-	-	1,220

1/ Sideline volume does not influence the allocation to the storage function. Its influence is only on the primary function -- grain merchandising or handling.

2/ This model includes, in addition to the new elevator, the old 20,000-bu. elevator and the costs incident to its operation in conjunction with the new one.

Note - See Table 20 for the sideline function expenses.

Table 23 - Slow or sticky expenses for the grain merchandising or handling function in the study models under various volume situations.[1]

Annual bushels merchandised or handled	Bushel capacity of personnel expenses for elevator models					
	Old 20,000	New 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
100,000	$1,383	$1,149	$1,505	$1,601	-	-
150,000	1,486	1,251	1,542	1,634	$1,606	-
200,000	1,613	1,376	1,578	1,667	1,689	-
250,000	1,725	1,489	1,686	1,700	1,773	-
300,000	–	–	1,794	1,804	1,857	$2,038
400,000	–	–	2,015	2,013	2,035	2,178
500,000	–	–	–	2,232	2,247	2,318
600,000	–	–	–	2,485	2,479	2,461
900,000	–	–	–	–	3,040	2,951
1,200,000	–	–	–	–	–	3,512
1,500,000	–	–	–	–	–	4,017

1/ The costs shown are for sideline volume of $145,000. When it is $30,000 the above costs are $20 more in each case mostly because of the difference in allocation of directors' fees.

2/ This model includes, in addition to the new elevator, the old 20,000-bu. elevator and the costs incident to its operation in conjunction with the new one.

Note - See Table 20 for the sideline functions.

Table 24 - Slow or sticky expenses for the grain storage function in the study models under various volume situations. 1/

Maximum storage capacity used	Personnel expenses for elevator models					
	Old 20,000	New 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
(Bushels)						
15,000	$126	$71	-	-	-	-
30,000	-	-	$224	-	-	-
60,000	-	-	248	$260	-	-
90,000	-	-	358	339	$347	-
120,000	-	-	-	418	448	-
180,000	-	-	-	547	549	$ 544
270,000	-	-	-	-	674	703
360,000	-	-	-	-	-	862
540,000	-	-	-	-	-	1,033

1/ The costs shown are for sideline volume of $145,000. When it is $30,000 the above costs are $2 more in each case mostly because of the difference in the allocation of directors' fees.

2/ This model includes, in addition to the new elevator, the old 20,000-bu. elevator and the costs incident to operating it in conjunction with the new one.

Note - See Table 20 for the sideline function expenses.

Slow or Sticky Expenses

If there were only two classifications of all elevator expenses -- fixed and variable -- slow or sticky expenses would be classed as variable. But for purposes of describing the allocation procedure and analyzing reaction of expenses to volume changes, a classification of the so-called variable expenses into more homogeneous groups seems desirable. Thus, the so-called variable expenses are divided into the following four groups: Personnel expenses, slow or sticky expenses, other variable expenses, and non-operating statement expenses. Those expenses that vary to some extent with volume but which have either managerial or actual minimum or maximum limits in responding to volume changes are the slow or sticky expenses. Examples of actual minimums are power and telephone expenses. Examples of managerial limitations are dues and subscriptions.

A second general characteristic of slow or sticky expenses is that their amount does not usually increase in direct ratio to increases in volume. Power rates, for example, are lower as consumption increases; dues and subscriptions, audit expense, and similar items will increase somewhat with higher levels of volume but not in proportion to the volume increase.

The amounts of this group of expqnses for various practical volume situations of the model elevators are shown in Tables 23 and 24.

From Table 23 it will be seen that the amount of these expenses for identical volume was about the same in the concrete elevators except where minimum expenses were encountered. For example, the 200,000-bushel elevator had higher expenses at 100,000-bushel volume merchandised or handled than those of the 100,000-bushel elevator. Or the same was true in the 600,000-bushel elevator compared to the 300,000-bushel elevator when volume in both cases was 300,000 bushels.

Certain types of repairs and maintenance accounted for most of the differences observed between the new 20,000-bushel elevator and the other elevator models.

Again, because of the difference between allocation of expenses to the primary and the secondary operations, these minimums were not important in amounts of expenses allocated to the storage function. The same is true for the sideline function although for this function only 2 different volume situations were shown in the models used.

Table 25 - Other variable expenses for the grain merchandising or handling function in the study models under various volume situations. 1/

Annual bushels merchandised or handled	Other variable expenses for elevator models					
	Old 20,000	New 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
100,000	$177	$159	$166	$167	-	-
150,000	213	193	197	197	$197	--
200,000	252	229	227	226	226	-
250,000	289	273	261	256	255	-
300,000	-	-	294	286	295	$276
400,000	-	-	355	345	345	335
500,000	-	-	-	406	405	394
600,000	-	-	-	468	466	452
900,000	-	-	-	-	622	622
1,200,000	-	-	-	-	-	785
1,500,000	-	-	-	-	-	964

1/ The costs shown are the same for either level of sideline volume used in the models.

2/ This model includes the old 20,000-bu. elevator in addition to the new one and it includes all variable costs incident to the unit operation of both elevators.

Note - See Table 20 for the amount of variable expenses for the sideline function, as well as the amount of fixed expenses for all 3 functions.

Table 26 - Other variable expenses for the grain storage function in the study models under various volume situations. 1/

Maximum storage capacity used	Other variable expenses for elevator models					
	Old 20,000	New 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
(Bushels)						
15,000	$538	$339	-	-	-	-
30,000	-	-	$142	-	-	-
60,000	-	-	272	$276	-	-
90,000	-	-	402	406	$ 405	-
120,000	-	-	-	537	536	-
180,000	-	-	-	798	799	$ 813
270,000	-	-	-	-	1,190	1,208
360,000	-	-	-	-	-	1,603
540,000	-	-	-	-	-	2,395

1/ The costs shown are the same for either level of sideline volume used in the models.

2/ This model includes the old 20,000-bu. elevator in addition to the new one, and it includes all variable costs incident to the unit operation of both elevators.

Note - See Table 20 for the amount of variable expenses for the sideline function, as well as the amount of fixed expenses for all 3 functions.

Other Variable Expenses

Expense items making up other variable expenses are insurance on stocks, plant and office supplies, fumigant, and interest on capital borrowed to handle seasonal fluctuations in commodities purchased or marketed. The amounts of these expenses vary more directly with volume than do any of the other four expense groups.

Tables 25 and 26 show other variable expense amounts for the specified practical volumes of the elevator models. Table 18 also shows the amount of variable expense for the $30,000 and the $145,000 sideline operating functions.

Expenses in this group were about the same for each of the elevator models in either of the grain functions when volume was the same. The only notable exception was the old 20,000-bushel elevator in which the insurance on stocks and some of the plant supplies was higher than those of the same volume handled through the new facilities -- particularly the concrete plants.

Non-Operating Statement Expenses

Non-operating statement expenses exist but are not shown as expenses on most country elevator regular operating statements. They are the operating costs of shrinkage, quality deterioration, and interest on all capital used regularly or continually throughout the year.

Tables 27 and 28 show the amounts of these expenses for each of the two grain operating functions of the model elevators for various practical volume situations. Table 20 shows the amounts allocated to the two side-line volume situations.

These expenses have different characteristics relating to their response to various volume situations from those of other expense groups. Some shrinkage is inevitable in the normal elevator grain handling practices, but the amount of the cost varies with volume, kind and condition of commodity, management grain weighing and grading practices and, to some degree, with type of elevator facility and equipment.

Quality deterioration is not inevitable, but it does occur under certain management practices. When it occurs the amount of the expense is related closely to volume.

Interest on all capital used regularly or continually throughout the year is a fixed amount of expense in relation to volume changes in a given size plant. Of course the amount varies substantially by size of plant.

Table 27 - Non-operating statement expenses for the grain merchandising or handling function in the study models under various volume situations. 1/

Annual bushels merchandised or handled	Non-operating statement expenses for elevator models 3/					
	Old 20,000	New 2/ 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
100,000	$1,544	$1,979	$3,054	$3,492	-	-
150,000	1,978	2,413	3,334	3,772	$4,184	-
200,000	2,404	2,839	3,619	4,052	4,464	-
250,000	2,834	3,269	3,894	4,332	4,744	-
300,000	-	-	4,174	4,612	5,024	$5,850
400,000	-	-	4,734	5,182	5,584	6,410
500,000	-	-	-	5,732	6,144	6,970
600,000	-	-	-	6,292	6,719	7,530
900,000	-	-	-	-	8,384	9,210
1,200,000	-	-	-	-	-	10,920
1,500,000	-	-	-	-	-	12,570

1/ Non-operating statement expenses for this function are the same for either level of sideline volume used in the study models.

2/ The model includes costs incident to the old 20,000-bu. elevator being operated in conjunction with the new one.

3/ Non-operating statement costs are: Interest on deferred liability and member equity capital, shrinkage, and quality deterioration. See Table 20.

Table 28 - Non-operating statement expenses for the grain function in the study models under various volume situations. 1/

Maximum storage capacity used	Non-operating statement expenses for elevator models					
	Old 20,000	New 20,000	New 3/ 100,000	New 3/ 200,000	New 3/ 300,000	New 3/ 600,000
(Bushels)						
15,000	$195	$448	-	-	-	-
30,000	-	-	$2,032	-	-	-
60,000	-	-	2,182	$3,604	-	-
90,000	-	-	2,352	3,772	$5,180	-
120,000	-	-	-	3,940	5,348	-
180,000	-	-	-	4,281	5,684	$9,341
270,000	-	-	-	-	6,195	9,845
360,000	-	-	-	-	-	10,349
540,000	-	-	-	-	-	11,357

1/ Non-operating statement expenses are the same for either level of sideline volume used in the models.

2/ Non-operating statement expenses are: Interest on deferred liability and member equity capital; shrinkage; and quality deterioration. See Table 20.

3/ The models include costs incident to operating the old 20,000-bu. elevator in conjunction with the new one.

Total Expenses

The total of the five expense groups for the grain merchandising or handling function is shown in Table 29. The total for the grain storage function is shown in Table 30 and for the sidelines in Table 20.

The amounts of the grain merchandising or handling costs were lowest at a given volume in the old 20,000-bushel elevator model, and highest in the 600,000-bushel elevator model. This situation would be expected mostly because of the larger fixed costs in the new and larger elevators.

At the lower volume levels of the larger concrete elevator models, there was also the influence of minimums in expense items in the personnel and slow or sticky expense groups, which further increased the amounts of total expenses compared to the smaller elevators.

Total costs allocated to the storage function were higher in the larger elevator models using the same amount of storage capacity, almost entirely because of larger amounts of fixed costs.

Table 29 - Total costs allocated to the grain merchandising or handling function under various volume situations of the study models. 1/

Annual bushels merchandised or handled	Total grain merchandising or handling costs for elevator models					
	Old 20,000	New 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
100,000	$ 8,082	$ 9,025	$13,159	$15,048	-	-
150,000	8,828	9,822	13,735	15,407	$17,409	-
200,000	9,649	10,638	14,325	15,944	17,694	$20,940
250,000	11,697	12,694	16,167	17,635	19,333	-
300,000	-	-	16,900	18,415	19,886	23,081
400,000	-	-	18,038	19,777	21,199	24,139
500,000	-	-	-	21,405	22,755	25,398
600,000	-	-	-	22,842	24,129	26,457
900,000	-	-	-	-	30,060	32,356
1,200,000	-	-	-	-	-	35,350
1,500,000	-	-	-	-	-	39,409

1/ The totals for grain merchandising or handling are on the basis of sideline volume being $145,000 annually. When sideline volume is $30,000 each figure shown was about $535 higher mostly because of large allocation of personnel expenses.

2/ The expenses shown include the cost of operating the old 20,000-bu. elevator in conjunction with the new elevator.

Table 30 - Total costs allocated to the grain storage function under various volume situations of the study models. 1/

Maximum storage capacity used	All grain storage costs for elevator models					
	Old 20,000	New 20,000	New 2/ 100,000	New 2/ 200,000	New 2/ 300,000	New 2/ 600,000
(Bushels)						
15,000	$1,282	$1,716	-	-	-	-
30,000	-	-	$5,842	-	-	-
60,000	-	-	6,162	$9,449	-	-
90,000	-	-	6,587	9,836	$13,014	-
120,000	-	-	-	10,224	13,446	-
180,000	-	-	-	11,001	14,178	$23,403
270,000	-	-	-	-	15,318	24,563
360,000	-	-	-	-	-	25,663
540,000	-	-	-	-	-	27,778

1/ The expenses shown are the same for either level of sideline volume used in the study models.

2/ The expenses shown include any costs that should be allocated to this function because of operating the old 20,000-bu. elevator in conjunction with the new facility.

ANALYSIS BY GRAIN FUNCTIONS

In considering the analysis of these synthetic costs it may be helpful to reemphasize the principal objective of the study. It was to develop more specific and dependable guides that management of a country elevator in the hard winter Wheat Belt could use to make a choice of the size of new elevator to build for their particular volume specifications and grain marketing operating environment.

Also, in considering the analysis to follow, the authors wish to recognize that further analysis and application of other statistical analytical methods appear to have considerable promise in simplifying the procedure used and in further refining the results shown. However, it is believed that additional analysis and analytical methods may be more appropriately conducted in an advanced study of the same problem, as it relates to the two grain operating functions, rather than as a part of this first formal research study using synthetic costs in developing the study objective.

Likewise, considering the objective and limitations of the study, the sideline functional analysis was limited in this study. It, too, deserves advance study from the viewpoint of developing a wider range of facts concerning itssinfluence on the operating costs of grain functions.

With the objective and limitations in mind, the further analysis of data on elevator models took into account the following for each of the grain functions: (1) Total unit costs, (2) relative economies of the various size elevators, (3) influence of facilities and equipment on costs, (4) influence of volume and management decisions on costs, and (5) reaction of total operating unit costs to plant and equipment cost situations other than those used in the original models.

Influence of Volume on Unit Costs by Elevator Sizes

The bushel is the most common non-variable unit associated with grain marketing operations. Thus, it is the most meaningful to operators dealing with their costs, margins or the competitive position of a specific proposed new elevator operation. Therefore, the influence of volume on costs as well as further analysis will deal with per-bushel costs.

Table 31 - Total cents per bushel costs of the grain merchandising or handling function under various volume situations of the study models. 1/

Annual volume merchandised or handled	Cents per bushel of capacity used in models					
	Old 20,000	New 20,000	New 100,000	New 200,000	New 300,00	New 600,000
(Bushels)						
100,000	8.08¢	9.03¢	13.16¢	15.05¢	--	---
150,000	5.89	6.55	9.16	10.27	11.61¢	--
200,000	4.82	5.32	7.16	7.97	8.85	10.47¢
250,000	4.68	5.08	6.47	7.05	7.73	--
300,000	--	--	5.63	6.14	6.63	7.69¢
400,000	--	--	4.51	4.94	5.30	6.03
500,000	--	--	--	4.28	4.55	5.08
600,000	--	--	--	3.81	4.02	4.41
900,000	--	--	--	--	3.34	3.60
1,200,000	--	--	--	--	--	2.95
1,500,000	--	--	--	--	--	2.63

1/ Unit costs are calculated from amounts of costs shown in Table 29. Sideline volume is \$145,000 for each model. At \$30,000 sideline volume the above expenses will each be higher by \$535 divided by volume of grain merchandised or handled.

The Grain Merchandising or Handling Function

Per bushel costs of merchandising or handling grain for the maximum annual volumes generally considered practical under conditions in the areas where hard winter wheat is the principal cash crop are shown for each of the elevator models in Table 31.

At the maximum practical volume level costs for merchandising or handling range from 5.08 cents per bushel in the new 20,000-bushel elevator to 2.63 cents in the 600,000-bushel elevator. Thus, there is an economy at maximum volume levels of nearly 2-1/2 cents per bushel or nearly one-half the cost of merchandising of handling grain in the samllest new elevator model.

On the other hand, as would be expected because of higher fixed costs, the larger the elevator the higher the unit costs at the same volume level. For example, at a 200,000-bushel annual volume, the new 20,000-bushel elevator has costs of 5.32 cents. At the same volume, costs were 10.47 cents for the new 600,000-bushel elevator.

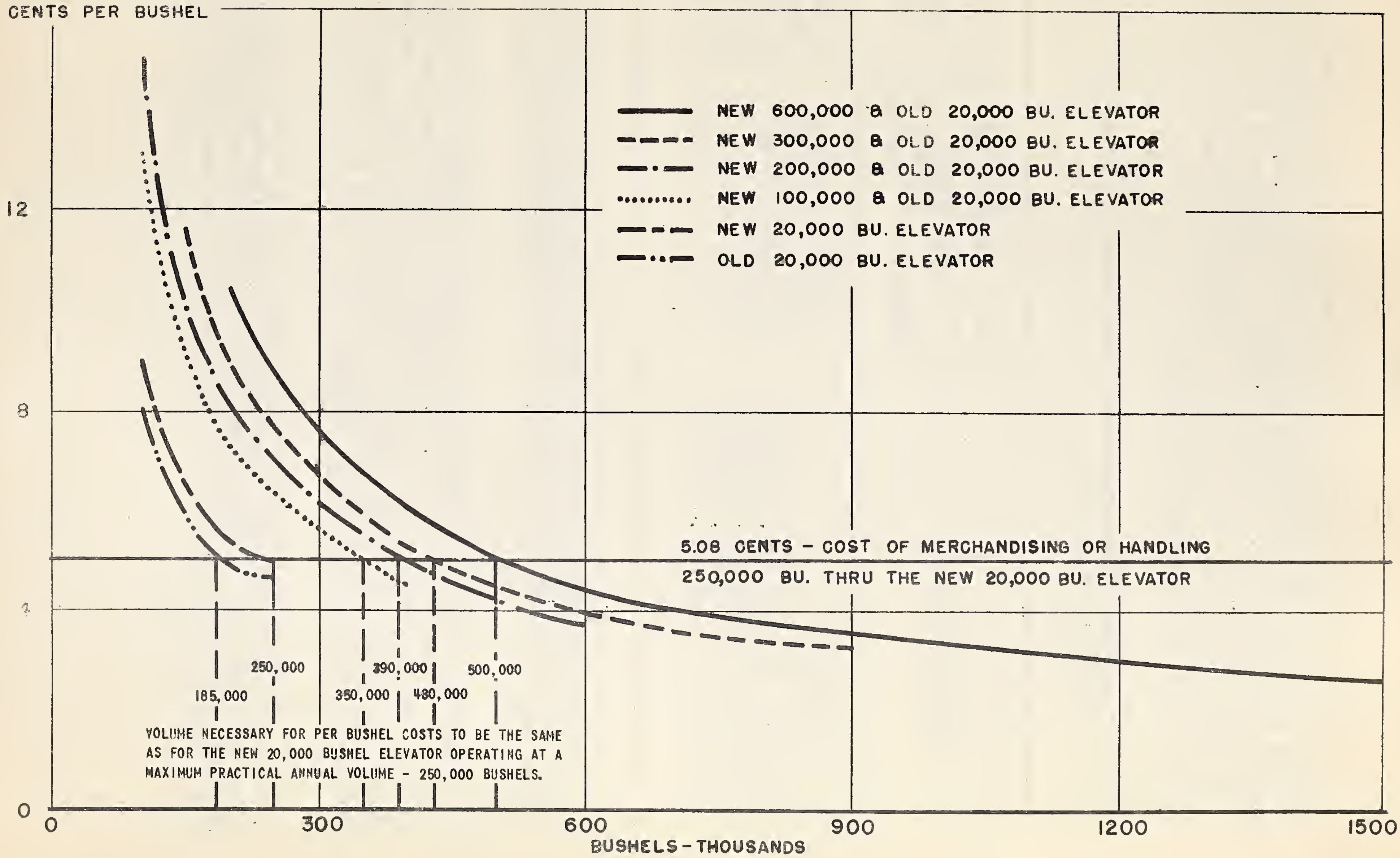
Figure 6 shows these costs graphically. By drawing a horizontal line intersecting at the curved line the unit cost of operating the new 20,000-bushel elevator at 250,000-bushel annual volume -- 5.08 cents -- it can be readily seen what additional volume will be necessary to operate the larger elevator models at the same per-unit costs as the smaller one. It takes 500,000 bushels or double the annual volume to operate the 600,000-bushel elevator at the same unit costs. The old 20,000-bushel elevator requires a volume of only 185,000 bushels to operate at the same unit costs. Table 32 shows the increases needed from the old 20,000-bushel elevator in the other elevator models to operate at 5.08 cents per bushel.

Table 32 - Increased volume necessary in model elevators to operate at 5.08 cents per bushel.

Elevator model	Annual Volume	Increase from preceding model	
		Volume	Size of ele.
Old 20,000-bu.	185,000	--	--
New 20,000-bu.	250,000	65,000	None
New 100,000-bu. plus old 20,000-bu.	350,000	100,000	100,000
New 200,000-bu. plus old 20,000-bu.	390,000	40,000	100,000
New 300,000-bu. plus old 20,000-bu.	430,000	40,000	100,000
New 600,000-bu. plus old 20,000-bu.	500,000	70,000	300,000

FIGURE 6

RELATION OF COST TO VOLUME OF GRAIN MERCHANDISED OR HANDLED, BY SIZE OF ELEVATOR



The relationship or ratio of the increase in bushels of additional volume needed to operate these different size new elevators at identical costs will be about the same at volumes between 150,000 and 250,000 bushels annually for the new 20,000-bushel elevator, regardless of where the horizontal line is drawn on the chart. This relationship will be considered further in the analysis of costs due to facilities and equipment and those due to volume and management decisions.

Table 33 - Elevator model practical volume range at per-bushel costs of 5.08 cents or less.

Elevator models	Volume Range		
	1,000 bushel		Percent of maximum practical
	Minimum	Maximum Practical	
Old 20,000-bu.	185,000	to 250,000	74 to 100
New 20,000-bu.	250,000	to 250,000	None
New 100,000-bu. plus old 20,000-bu.	350,000	to 400,000	88 to 100
New 200,000-bu. plus old 20,000-bu.	390,000	to 600,000	60 to 100
New 300,000-bu. plus old 20,000-bu.	430,000	to 900,000	48 to 100
New 600,000-bu. plus old 20,000-bu.	500,000	to 1,500,000	33 to 100

From the foregoing table it becomes evident that the largest elevator models can compete with the smallest models successfully under a much wider volume range when they have sufficient volume available to justify their construction in the first place.

The 600,000-bushel elevator can operate at one-third its maximum practical volume and still not have per bushel costs higher than the new 20,000-bushel elevator operating at maximum practical volume. However, it should be noted that volume necessary to operate at 5.08 cents per bushel is 250,000 bushels annually for the new 20,000-bushel elevator and 500,000 bushels for the 600,000-bushel elevator.

The foregoing situation gives the large country elevator located with a trade territory that will normally give it a million-bushel annual volume a big advantage over a small elevator in the same area which because of facility size cannot merchandise or handle more than one-fourth of a million bushels annually.

The foregoing data shows that any new elevator model storing a given number of bushels will show lower per bushel costs than the next storing the same number of bushels. For example, Table 31 shows that the new 100,000-bushel elevator's grain merchandising or handling function operates at 4.51 cents per bushel at maximum volume of 400,000 bushels annually. The 200,000-bushel elevator model handles the same volume at a cost of 4.94 cents per bushel; the 300,000-bushel elevator model at 5.30 cents; and the 600,000-bushel model at 6.03 cents. In other words, from three-tenths to four-tenths of a cent per bushel is added to costs when annual volume is 400,000 bushels and the size of the elevator increases by 100,000 bushels above the next smaller size elevator that can handle that volume when operating at nearest its maximum volume capacity.

To the practical operator these facts indicate that for maximum economy it is best to build as small a new elevator as will handled expected annual volume. They put emphasis on the importance of elevator and equipment handling capacity and railroad siding capacity in order to ship cars at a high rate during the harvest movement.

A good general rule or guide for new elevator construction is to have equipment and elevator railroad siding to ship stored as well as purchased grain during the harvest season to the extent that terminal elevator capacity and railroad facilities will normally permit. Thus, the local elevator gains the advantage of as much turnover at the local level as practical under the farm-to-elevator grain movement conditions existing locally.

Grain Storage Function

Considering only the new elevator models and costs at full utilization of capacity, costs per bushel of capacity used are less than half as high in the 600,000-bushel elevator as in the new 20,000-bushel plant -- 5.14 cents compared to 11.44 cents,

But, as has been pointed out for the merchandising or handling function, storage costs at identical amounts of capacity used are considerably higher as the size of the elevator increases.

For example, 90,000 bushels of capacity used costs 7.32 cents, 10.92 cents, and 14.46 cents per bushel respectively in the 100,000, 200,000, and 300,000 bushel elevator models.

Figure 7 shows storage cost volume relationships graphically. This figure also shows the bushels and percent of capacity that must be utilized in the 200,000, 300,000, and 600,000-bushel capacity elevators in order for costs per unit used to be the same as in the 100,000-bushel plant at full utilization of its storage space.

Table 34 - Costs of the grain storage function under various volume situations in the study models.1/

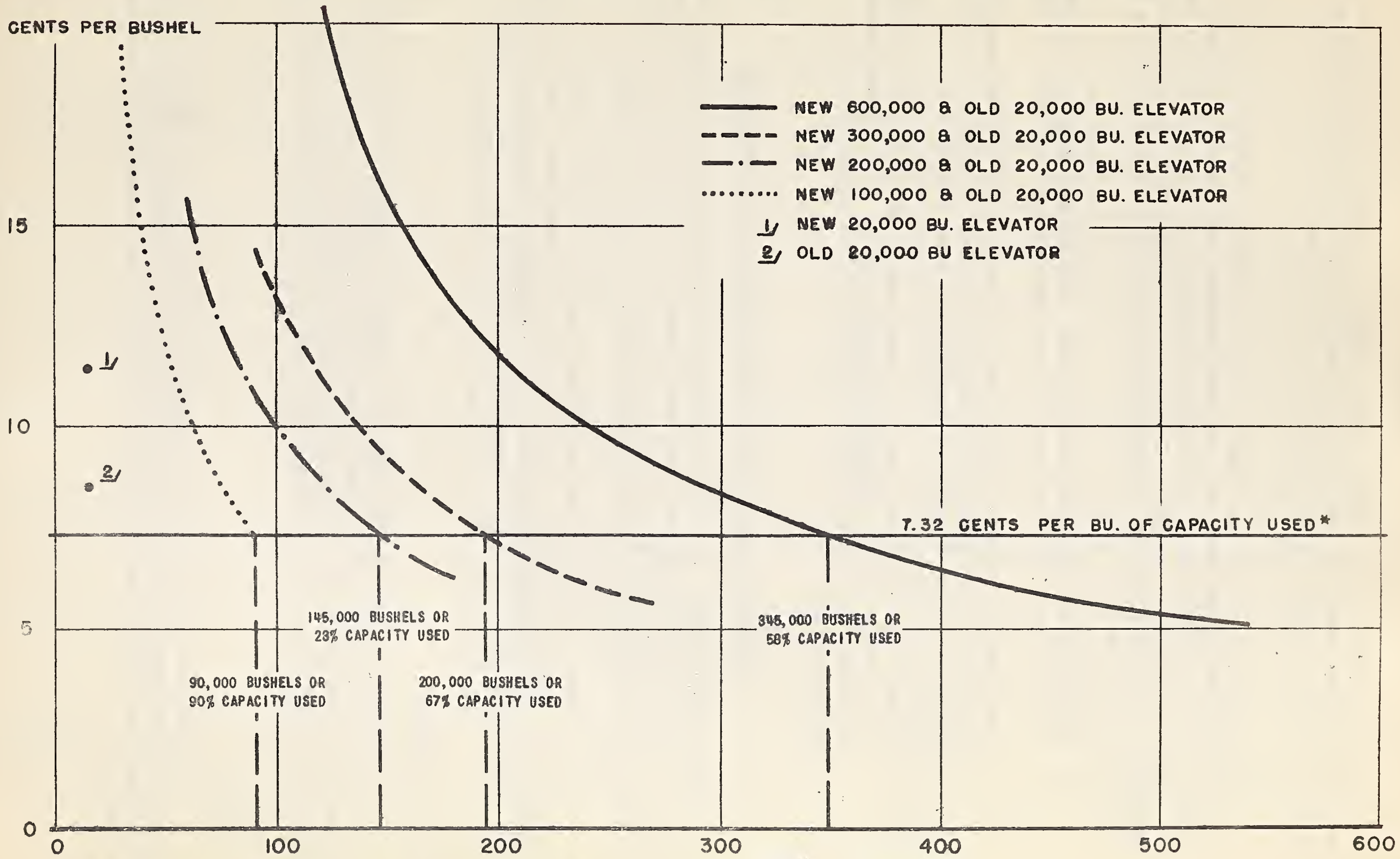
Maximum storage capacity used	Cents per bushel by various capacities of model elevators					
	Old 20,000	New 20,000	New2/ 100,000	New2/ 200,000	New2/ 300,000	New2/ 600,000
(Bushels)						
15,000	8.54¢	11.44¢	--	--	--	--
30,000	--	--	19.47¢	--	--	--
60,000	--	--	10.27	15.74¢	--	--
90,000	--	--	7.32	10.92	14.46¢	--
120,000	--	--	--	8.52	11.21	20.40¢
180,000	--	--	--	6.11	7.88	13.00
270,000	--	--	--	--	5.67	9.10
360,000	--	--	--	--	---	7.13
540,000	--	--	--	--	--	5.14

1/ The expense shown are the same for either level of sideline volume used in the study models.

2/ The costs shown include all expenses that should be allocated to this function because of the operation of the 20,000-bu. old elevator in conjunction with the new facility.

FIGURE 7

RELATION OF COST TO VOLUME OF GRAIN STORED, BY SIZE OF ELEVATOR



*NEW 100,000 BU. ELEVATOR EXAMPLE USING 90,000 BU. OF AVAILABLE CAPACITY.

As described for the primary grain function, the storage function also has a much wider range in capacity utilization in the largest compared to the smaller elevator models, when operating at the same or lower per bushel cost of storage capacity used.

The foregoing tables and charts show the reaction of total costs of each of the grain functions for the study models under various volume situations. From them, we have clear-cut evidence of the importance of the proper size -- volume relationships for maximum operating efficiency. Management, considering size of new facilities to build, may count on the following conditions:

1. Substantial economies in the larger facilities only when volume is sufficient to allow use at near the maximum practical levels.

2. Much more favorable competitive position in the larger facilities during years of lower than normal grain production when normal volume is high enough to justify the larger facility.

3. Relatively high costs when the size selected is so much larger in relation to the average or normal volume to be merchandised or handled and stored that a 100,000-bushel smaller elevator would suffice.

Relative Influence of Fixed and variable expenses

With these points in mind the analysis will proceed to determine why total costs react as they do, what their reaction would be under building and equipment costs different from those used in the study models and, finally, what guides for future building are reasonably dependable.

The preceding analysis has shown the reaction of five groups of expenses to various levels of practical volume situations. Now that the reaction of specific groups of reasonably homogeneous expenses are known, the original 5 groups can be combined into 2 groups of expenses and the analysis simplified. The two new groups making up all expenses are:

Fixed expenses

Due mostly to direct facility and equipment expense. Fixed expenses will now include interest on the minimum of all capital used regularly throughout the year. This expense is taken out of the fifth group -- non-operating expenses -- and included with the total of the first group shown in Table 4.

Variable

Expenses due to volume and management decisions. This group now includes: Personnel expenses, slow or sticky expenses, other variable expenses, and shrinkage and quality deterioration costs from the non-operating statement expenses.

Fixed Expenses -- Due Mostly to Plant and Equipment

Table 35 shows the makeup of the fixed expenses for the two grain operating functions. All grain merchandising or handling fixed expenses varied from $2,175 for the old 20,000-bushel elevator model to $13,177 for the new 600,000-bushel elevator models. For the storage function the variation was from $207 to $20,230 for the respective models. For either grain function, Table 34 shows that fixed expenses directly associated with the elevator and equipment constituted by far the greater part of total fixed expenses Particularly, in the storage function, other fixed expenses were negligible compared to those due directly to the elevator facility and equipment.

Influence of Plant or Equipment Investment on Total Expense

Table 36 contains some significant guides for elevator management. It indicates the ratio of investment in plant design and equipment to savings of variable expense items at which a higher investment will increase total unit costs and a lower investment will decrease them.

For the elevator building, fixed costs varied from 11.6 to 8.5 percent of the building cost or the capital investment. In other words, depending on the elevator model, it took from $9.00 to $11.70 of fixed capital investment in the elevator building to result in $1.00 of fixed expense. Elevator design influences such annual operating cost items as personnel expense, shrinkage, quality deterioration, power, maintenance, and repairs. Obviously, if improved design results in sufficient savings in annual operating variable expenses to more than offset the additional fixed cost caused by the design change, then overall per unit operating costs have been lowered. Therefore, any amount of additional plant cost that is less than from $9.00 to $11.70 may be invested to improve elevator design that results in $1.00 savings in labor, power, shrinkage, and so on. If a plant design change in the 600,000-bushel elevator model can save a man's salary at $4,000 annually, any additional investment necessary for the design change up to $46,000 will result in overall savings in operating cost per unit of volume.

Because the rate of depreciation is higher on equipment than on the elevator building, the fixed expenses for equipment varied from 15.3 to 16.6 percent of the equipment investment cost. In other words, an investment in equipment of $6.00 to $6.50 -- depending on the study model -- that resulted in $1.00 saved in labor, power, repairs, shrinkage, quality maintenance and other such costs resulted in overall per unit savings in operating costs.

Table 35 - Analysis of fixed expenses or those due mostly to plant and equipment for each of the elevator models.

Elevator models	Item	The grain merchandising or handling function					The grain storage function			
		Expense of depr., insurance, taxes and interest on invest.		Interest on regular working capital[3]	Other fixed expenses[4]	Total fixed expenses	Expense of depr., insurance, taxes and interest on investment		Other fixed expenses[5]	Total fixed expenses
		Plant[1]	Equipment[2]				Plant	Equipment		
Old 20,000-bu.	Valuation	$ 2,000[6]	$10,100	$5,000	$ –	$ –	$ –	$ 900	$ –	$ –
	Expense	336	1,564	200	75	2,175	44	138	25	207
New 20,000-bu.	Valuation	11,010	11,970	5,000	–	–	6,005	1,230	–	–
	Expense	1,272	1,877	200	75	3,424	666	204	25	895
New 100,000-bu. plus old	Valuation	28,000	28,850	5,500	–	–	39,000	7,150	–	–
20,000-bu.	Expense	2,482	4,466	220	384	7,552	3,339	1,187	116	4,642
New 200,000-bu. plus old	Valuation	33,200	34,100	6,000	–	–	72,800	8,900	–	–
20,000-bu.	Expense	2,931	5,271	240	686	9,128	6,223	1,455	173	7,851
New 300,000-bu. plus old	Valuation	37,500	38,600	7,500	–	–	106,500	10,400	–	–
20,000-bu.	Expense	3,290	5,974	300	1,013	10,577	9,072	1,702	230	11,004
New 600,000-bu. plus old	Valuation	47,400	47,860	9,000	–	–	181,600	27,140	–	–
20,000-bu.	Expense	4,123	7,329	360	1,365	13,177	15,552	4,378	300	20,230

[1] Office building was included as plant expense at $2,000. See Tables 1 and 20 for valuation allocation and cost.

[2] Truck scale and office equipment included at $5,000. See Table 1.

[3] This was the amount of, and interest at 4 percent on, working capital used regularly throughout the year or minimum requirements as contrasted to seasonal working capital. See Table 20.

[4] Other fixed expenses were the portion of personnel expenses due to facility size, capital stock tax, employees' bonds and railroad lease.

[5] Other fixed expense was the state warehouse bond and personnel expense due to size of facility.

[6] Old elevator building was depreciated completely but for insurance and tax purposes it had a replacement value of about $9,000.

Note - These expenses all remained the same regardless of annual volume merchandised or handled, or the amount of available storage capacity used.

Note - Ratio of grain merchandising or handling plant and equipment expense to valuations were about one to 8.8 and 15.5 respectively for the new concrete elevator models. For the storage function they were about 1 to 8.5 for plant and 1 to 16.3 for equipment.

Table 36 - Percentage relationships of the expense of depreciation, interest, taxes and insurance to the investment or cost of plant and equipment and the ratio at which these investment costs equal a dollar saved in variable costs for the elevator models. 1/

Elevator models	Grain merchandising or handling				Grain storage			
	Plant		Equipment		Plant		Equipment	
	Percentage	Ratio 2/	Percentage	Ratio 2/	Percentage	Ratio 2/	Percentage	Ratio 2/
Old 20,000-bu. 3/								
New 20,000-bu.	11.6	$1 to $9.00	15.7	$1 to $6.40	11.1	$1 to $9.00	16.6	$1 to $6.00
New 100,000-bu. plus old 20,000-bu.	8.9	1 to 11.30	15.5	1 to 6.50	8.6	1 to 11.70	16.6	1 to 6.00
New 200,000-bu. plus old 20,000-bu.	8.8	1 to 11.30	15.5	1 to 6.50	8.6	1 to 11.70	16.4	1 to 6.10
New 300,000-bu. plus old 20,000-bu.	8.8	1 to 11.40	15.5	1 to 6.50	8.5	1 to 11.70	16.4	1 to 6.10
New 600,000-bu. plus old 20,000-bu.	8.7	1 to 11.50	15.3	1 to 6.50	8.5	1 to 11.70	16.1	1 to 6.20

1/ Percentages and ratios are calculated from data shown in Table 33.
2/ Ratio of variable expense to cost of investment on facility or equipment.
3/ No depreciation or interest. Insurance and taxes based on $7,500 valuation.

Note - Expense of investment or cost of all new facilities used in the models expressed in percentage of investment or cost is shown in Tables 2 and 3 for depreciation and insurance. The tax rate is 1.37 percent and interest is 4 percent. The variations shown above are due to the relative weight of depreciation and insurance rate making up the composite percentage or ratio on both the old and new elevators. On a new concrete elevator plant by itself the composite rate will be 8.43 percent. On equipment it will be 14.37 percent.

The procedure for calculating the economy of an additional investment in elevator building or equipment that does not result in additional volume or gross income is to take the total of the rates of interest, depreciation, insurance, and taxes on the proposed additional investment and divide it into 100. The result equals the dollar ratio of investment to savings. If the equipment, such as a dryer or cleaner, or design change attracts additional volume or itself provides another service from which additional gross income is derived, that too should be considered in deciding on the economy of the additional investment.

All Variable Expenses -- Due to Volume and Management Decisions

Costs shown in Tables 37 and 38 are the remainder of total costs for the two grain functions not included in fixed costs (Table 35). They include most of personnel expenses, all slow or sticky expenses, all other variable expenses, as well as shrinkage and quality deterioration from the non-operating expense group.

Influence of Size of Elevator

The important characteristics of the expenses shown in Tables 37 and 38 is that size of model facility has very little influence on per unit costs at comparable volumes. At lower volume levels the variation from one elevator model to another was not more than three-tenths of a cent per bushel merchandised or handled (Table 37). Minimum power bills in the larger elevators accounted for most of the variation. At volumes of 400,000 bushels or more, it was either the same or the difference was not more than one-tenth of a cent for the different elevator models. The variation was even less for the storage function (Table 38).

In other words, management considering various size elevators with standard equipment and the same basic design, at a given location should figure that costs due to volume and to management decisions will be about the same regardless of the size of elevator they select. Differences in total unit costs observed in Tables 21 and 32 can be attributed almost entirely to fixed expenses -- due mostly to size of plant and equipment.

Of course, costs due to volume and management decisions may vary substantially compared to those at the same volume at another location, if rates of expense and management are different. But from the standpoint of deciding on size of plant and equipment for a particular location,, variable expenses are not an important factor in making the decision.

Table 37 - Variation due to volume in the total cost and the per bushel cost of grain merchandising or handling for the study elevator models. 1/

Annual volume merchandised or handled	Costs on various bushel capacities of elevator models 2/					
	Old 20,000	New 20,000	New3/ 100,000	New3/ 200,000	New3/ 300,000	New3/ 600,000
(Bushels)						
100,000						
Total	$5,907	$5,602	$ 5,607	$5,920	-	-
Per bushel	5.9¢	5.6¢	5.6¢	5.9¢	-	-
150,000						
Total	6,653	6,399	6,183	6,279	$ 6,852	-
Per bushel	4.4¢	4.3¢	4.1¢	4.2¢	4.6¢	-
200,000						
Total	7,474	7,215	6,773	6,816	7,137	-
Per bushel	3.7¢	3.6¢	3.4¢	3.4¢	3.6¢	-
250,000						
Total	9,522	9,271	8,615	8,507	8,806	-
Per bushel	3.8¢	3.7¢	3.4¢	3.4¢	3.5¢	-
300,000						
Total	-	-	9,348	9,287	9,329	$ 9,903
Per bushel	-	-	3.1¢	3.1¢	3.1¢	3.3¢
400,000						
Total	-	-	10,486	10,649	10,642	10,961
Per bushel	-	-	2.6¢	2.7¢	2.7¢	2.7¢
500,000						
Total	-	-	-	12,272	12,198	12,220
Per bushel	-	-	-	2.4¢	2.4¢	2.4¢
600,000						
Total	-	-	-	13,714	13,572	13,279
Per bushel	-	-	-	2.3¢	2.3¢	2.2¢
900,000						
Total	-	-	-	-	19,530	19,178
Per bushel	-	-	-	-	2.1¢	2.1¢
1,200,000						
Total	-	-	-	-	-	22,172
Per bushel	-	-	-	-	-	1.8¢
1,500,000						
Total	-	-	-	-	-	26,231
Per bushel	-	-	-	-	-	1.7¢

1/ The expenses shown were all other expenses not shown in Table 34 - Fixed Expenses. They included most of personnel expenses, all slow or sticky expenses, all variable expenses and shrinkage and quality losses.

2/ Management would ordinarily be a factor in the variations shown. However, every effort was made to budget these costs on the basis that management was comparable for the level of responsibility existing in each model. Therefore the variations shown were believed to be due to the different level of annual volume shown for each model.

3/ This model included the appropriate costs incident to operating the old 20,000-bu. elevator in conjunction with the new one.

Note - Sideline volume in each example was $145,000 for the expenses shown. When it was $30,000 annually, each figure shown was about $535 higher.

Table 38 -- Variation due to volume stored in the total cost and the per-bushel cost of grain storage function for the elevator models. 1/

Maximum storage capacity used	Costs on various bushel capacities of elevator models2/					
	Old 20,000	New 20,000	New 3/ 100,000	New 3/ 200,000	New 3/ 300,000	New 3/ 600,000
(Bushels)						
15,000						
Total	$1,075	$821	$1,050	–	–	–
Per bushel	7.17¢	5.47¢	7.00¢	–	–	–
30,000						
Total	–	–	1,200	–	–	–
Per bushel	–	–	4.00¢	–	–	–
60,000						
Total	–	–	1,520	$1,598	–	–
Per bushel	–	–	2.53¢	2.66¢	–	–
90,000						
Total	–	–	1,945	1,985	$2,010	–
Per bushel	–	–	2.16	2.21¢	2.23¢	–
120,000						
Total	–	–	–	2,373	2,442	–
Per bushel	–	–	–	1.98¢	2.04¢	–
180,000						
Total	–	–	–	3,150	3,174	$3,173
Per bushel	–	–	–	1.75¢	1.76¢	1.76¢
270,000						
Total	–	–	–	–	4,314	4,333
Per bushel	–	–	–	–	1.60¢	1.60¢
360,000						
Total	–	–	–	–	–	5,433
Per bushel	–	–	–	–	–	1.51¢
540,000						
Total	–	–	–	–	–	7,548
Per bushel	–	–	–	–	–	1.40¢

1/ The expenses shown were all other expenses not included in Table 34 - Fixed Expenses. They were most of personnel expenses, all slow or sticky expenses, variable expenses, and shrinkage and quality losses.

2/ Management would ordinarily be a factor influencing the variations shown. However every known effort was made to budget these costs on the basis that management was comparable for the respective level of responsibility existing in each model. Therefore the variation shown was believed to be due to different levels of annual volume shown for each elevator model.

3/ This model included the appropriate expenses incident to operating the old 20,000-bu. elevator in conjunction with the new one.

Note - Sideline volume was not a factor influencing storage costs at any volume level.

On the other hand, fixed expenses are the important factor in making such a decision. To estimate or project the amount of annual operating cost differences for the sizes of elevators under consideration, it is only necessary to figure the differences in their fixed expenses for the average volume anticipated at the proposed location. The difference in fixed cost per bushel will for practical purposes also be the difference in total costs at volume levels above a single turnover of the largest of the proposed new elevators under consideration. That is a simple and easy calculation once management has from their elevator construction engineer building and equipment cost estimates for elevator sizes under consideration.

Contribution to Economy of Scale

Expenses due to volume and management decisions include most of personnel expenses which are slow in responding to volume change. At low volume levels below a single turnover in the concrete elevators, manager's compensation, particularly, takes on the characteristics of fixed expenses in its response to those levels of volume. The slow or sticky expenses are also included in costs due to volume and management decisions. They also tend to resist change directly in proportion to volume. At low levels they are practically fixed. At higher levels they usually increase at a slower rate than the rate of volume increases. Power expense is a good example of these characteristics of slow or sticky expenses. Figures 8 and 9 graphically show fixed and the so-called variable expenses for the two grain functions. The heavy line on Figures 8 and 9 shows costs due to volume and management decisions -- variable expenses -- for these functions.

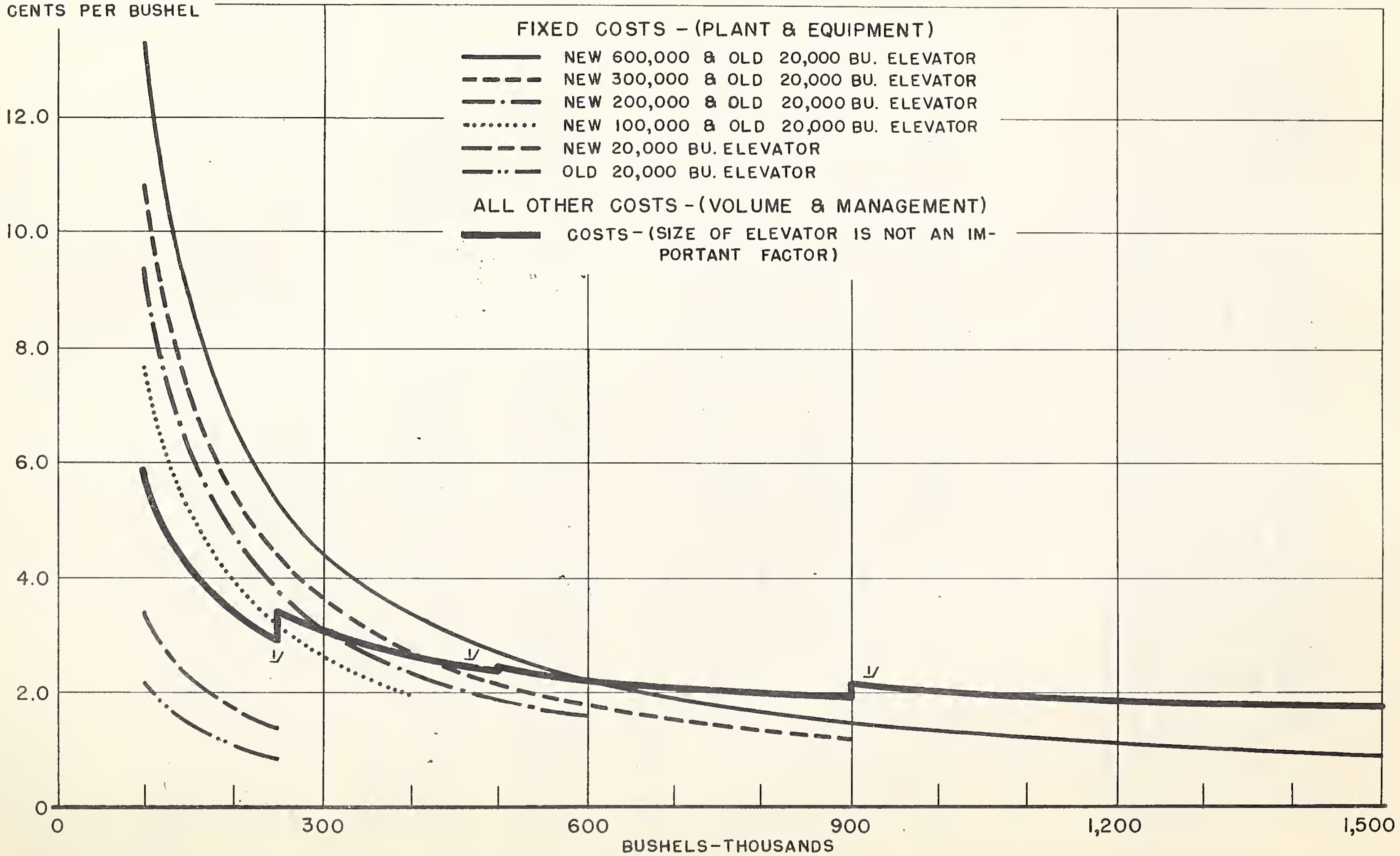
Figure 8 shows that all variable costs decreased about 1-1/2 cents per bushel from the 300,000-bushel to the 1,500,000-bushel volume levels -- a range of 1,200,000 bushels. From 100,000 bushels to 300,000 bushels, variable costs decreased 2-1/2 cents over a 200,000-bushel range.

Figure 9 shows a decrease in variable unit costs for storage of 1 cent between 90,000 bushels and 540,000 bushels of storage capacity used -- a range of 450,000 bushels. From 30,000 bushels to 90,000 bushels -- or within a range of only 60,000 bushels -- unit costs decreased 1.8 cents per bushel of capacity used.

Therefore, another characteristic of so-called variable costs -- due to volume and management decisions -- is their contribution to economies of scale. There are economies in per unit costs for both grain functions due to variable costs, as well as to fixed costs. However, as indicated by Figures 8 and 9 per unit economies from fixed costs were considerably greater than variable costs from the low to the high part of the volume scale.

FIGURE 8

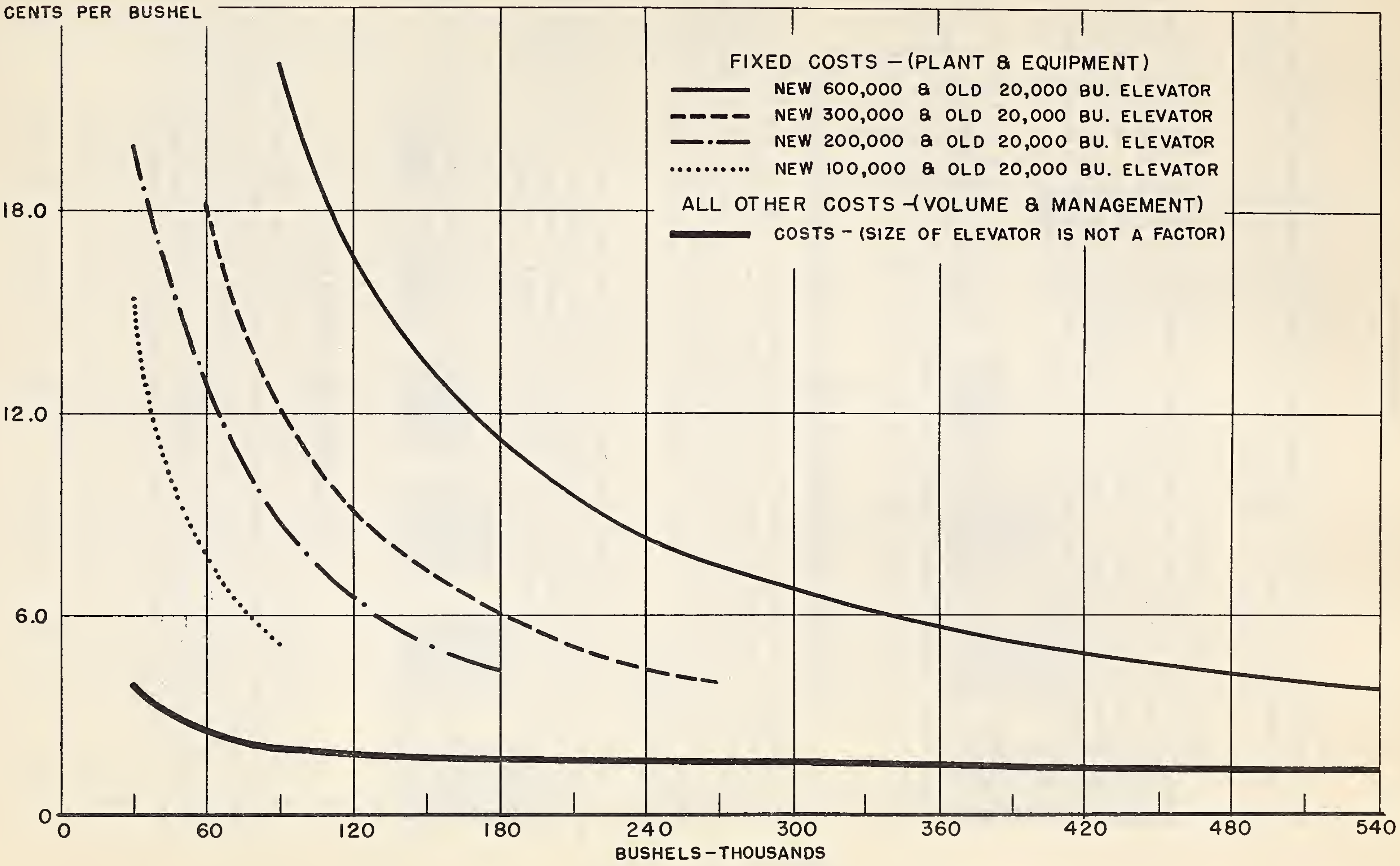
RELATION OF FIXED AND OTHER COSTS TO VOLUME OF GRAIN MERCHANDISED OR HANDLED BY SIZE OF ELEVATOR



[1] POINTS AT WHICH REGULARLY EMPLOYED PERSONNEL WERE ADDED.

FIGURE 9

RELATION OF FIXED AND OTHER STORAGE COSTS TO STORAGE CAPACITY USED BY SIZE OF ELEVATOR



While the fixed cost curve is typical and the type generally known and expected, much less information is available concerning the relation of the variable costs on these costs due to volume and to management decisions and changes in volume.

Actually the variable cost curve is about as would be expected when consideration is given to individual items of expense making up these costs. Power rates per kilowatt-hour decrease as consumption increases. The time of regular employees and of the directors is used more efficiently in higher-volume plants. Dues, subscriptions, donations, meetings and auditing and tax service are a few expense items that are responsible for some economy of scale from the so-called variable costs.

Figures 8 and 9 point up the differences existing in the two grain functions in the relative importance of fixed costs compared to variable costs. For the merchandising or handling function, fixed per unit costs constitute a much lower portion of total costs, particularly at the upper half of the volume scale than is the case for the storage function.

Relative Importance of the Two Expense Item Groups

Figures 10 and 11 show in a different way some of the relationships previously discussed between fixed expenses -- due mostly to plant and equipment -- and all variable expenses -- due to volume and management. These figures also point up more clearly the reaction between these two groups of expenses, on both an amount and per unit basis for each of the grain functions.

The per unit figures for low and high volume situations show the economy of scale for each elevator model and function. As previously pointed out, costs due to volume and management decisions do contribute to per unit cost economies -- though not nearly as much as do fixed costs.

Figures 10 and 11 also point up a little more clearly than Figures 8 and 9 the relative importance of fixed expenses for the two grain operating functions.

Other Building Situations

The next problem for analysis is to determine to what extent the operating cost relationships that exist for the different elevator models used in the study will continue about as they are when different building costs or equipment installations are used. For that analysis, unit costs for the elevator models were calculated for the following situations that were different from those used in the original study models:

FIGURE 10

RELATION OF FIXED EXPENSE TO TOTAL EXPENSE OF GRAIN FUNCTIONS AT HIGH AND LOW PRACTICAL VOLUME LEVELS, BY SIZE OF ELEVATOR

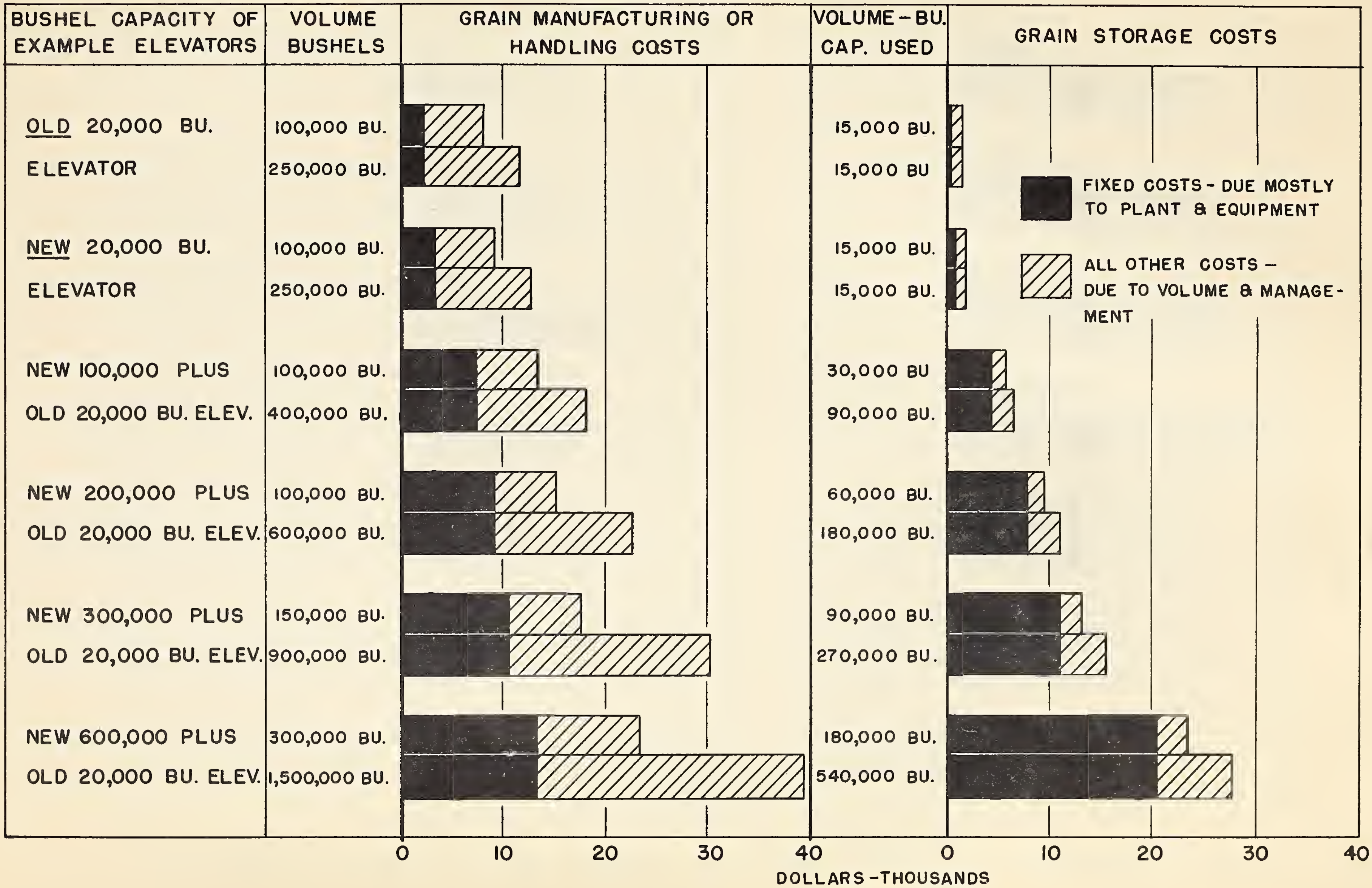
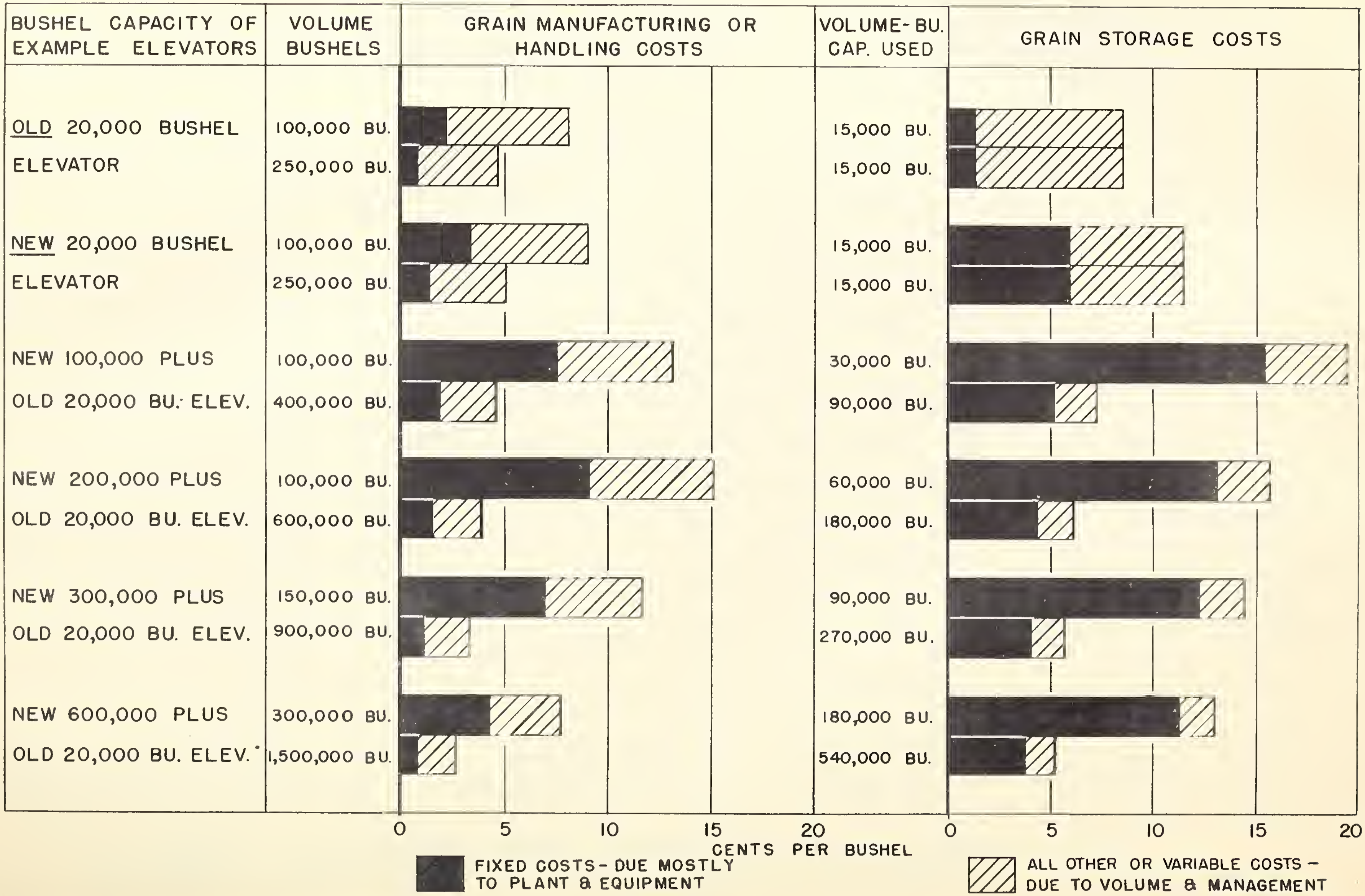


FIGURE 11

RELATION OF COST TO FIXED EXPENSE OF GRAIN FUNCTIONS AT HIGH AND LOW PRACTICAL VOLUME LEVELS, BY SIZE OF ELEVATOR



1. Operation of the new concrete elevator without the old 20,000-bushel elevator , the old one is torn down when the new larger elevator is ready for operation.
2. Operation of the new elevator models with the addition of an expensive piece of equipment -- a dryer costing $20,000.
3. Operation of the new elevators assuming building and equipment costs or valuations to be both 20 percent higher and 20 percent lower than those used in the original study models.

Influence of Old Elevator Operating in Conjunction With the New

If an old elevator is destroyed by fire this will not be a problems for management decision. However, most new concrete elevators with capacity of 100,000 bushels or more are now being operated in conjunction with their old plant. This old plant adds to total operating costs. A decision must be made as to how much it adds to costs and whether it adds enough to volume and flexibility of operations to justify the additional costs. Management will have the best basis for making the decision to keep or to tear down the old elevator when they know how much it adds to costs.

Since the old elevator is used to merchandise and handle feed grains retailed locally and to supplement receiving and loading out capacity at harvest time, that function rather than the storage function, is mostly involved in the problem. Table 39 shows the cost items involved and the total amounts by functions.

Since storage costs were not substantially affected, Figure 12 shows total merchandising or handling costs for selected size facilities with and without the old elevator. These should be considered as minimum additional costs caused by operating the old elevator in conjunction with the new one. It was assumed that no additional personnel expense was involved. Under some arrangements of the old elevator in relation to the office and the new elevator, and under some management situations, additional personnel expense would result for the combined plant operation. Therefore, the amount involved should be added to the costs shown in Table 39.

Because of the way the old elevator was used to operate in conjuction with the new concrete elevator such expenses as repairs and maintenance, plant supplies, and insurance on stocks remained about the same for the combined operation regardless of volume. From that standpoint these expenses also were fixed at overall volume levels high enough that considerations of power and other minimum expenses were not encountered. So, in eliminating the minimum amounts of costs contributed by the operation of the old elevator in conjunction with the new one, the $1,217 lower costs were the same regardless of the size of the new concrete elevator or the volume merchandised or handled. (Figure 10)

Table 39 - Old 20,000-bu. elevator costs that are additions to operating the new concrete elevator models independently.

Expense item	Merchandising or handling			Storage		
	Plant	Equipment	Total	Plant	Equipment	Total
Depreciation	-	$510	$510	-	$ 90	$ 90
Taxes	$100	66	166	$32	13	45
Insurance	64	43	107	12	-	12
Interest	-	204	204	-	45	45
Sub-total-fixed costs	164	823	987	44	148	192
Power & lights 1/	-	-	-	-	-	-
Repairs & maintenance 2/	-	-	175	-	-	-
Plant supplies 3/	-	-	20	-	-	-
Insurance on stocks 4/	-	-	35	-	-	-
Other expense 5/	-	-	-	-	-	-
Totals			$1,217			$192

1/ At a cost of 5 cents per bushel, volume would be sufficient so that power minimum would not be a factor. At low annual volumes it was an additional cost because of minimum power bills. At 100,000-bu. volume the old elevator operation should be charged with adding $121 to the power bill.

2/ Of the $250 charged for repairs and maintenance of the old elevator it was estimated that eliminating it would reduce the total by $200 for the same volume.

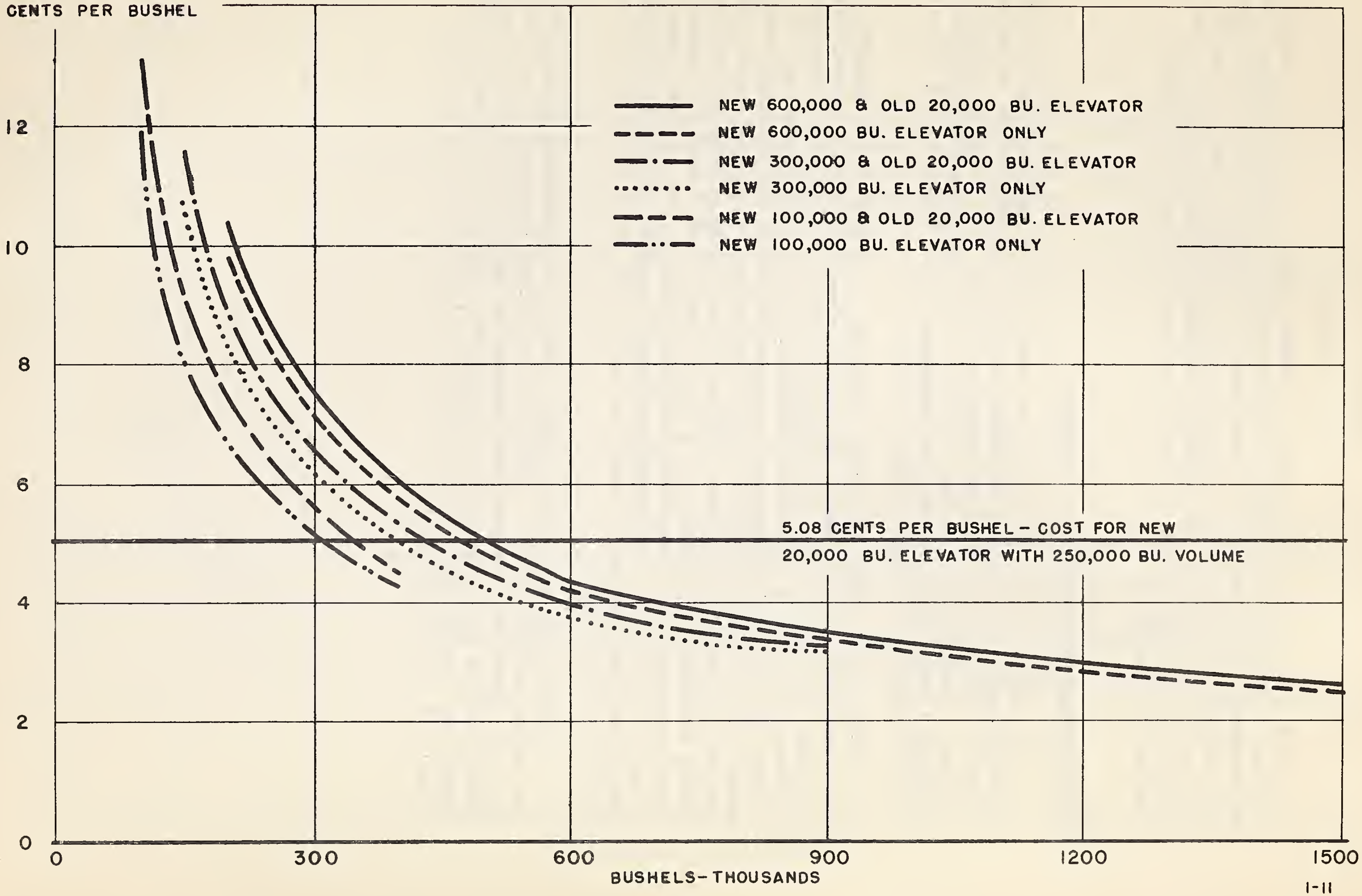
3/ Primarily differences in fumigation costs in old elevator.

4/ Insurance on stocks was the difference in costs of carrying stocks budgeted in the old elevator as additions to those previously carried in the new concrete elevator.

5/ Other expenses such as extra personnel expense should be added here if they apply to a specific situation.

FIGURE 12

RELATION OF COST TO VOLUME OF GRAIN MERCHANDIZED OR HANDLED BY NEW ELEVATOR WITH AND WITHOUT OLD ELEVATOR



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That being true, the additional annual volume necessary to make the combined operations fall within the unit cost of 5 cents per bushel, which was required for operating the new concrete elevator by itself was the same size or 30,000 bushels. In other words, 30,000 bushels of additional volume was necessary to the combined operationsof both to achieve the same 5 cents per bushel unit costs that prevailed when the new elevator operated by itself.

Adding Expensive Equipment -- a Dryer

The addition of a $20,000 dryer added $2,900 to fixed expenses of each elevator model. The drying equipment was used to improve the market value of grain that contained excess moisture. It was not used for a custom service. Therefore the drying operation was a grain merchandising or handling function and as such its ownership added $2,900 to the fixed cost of that function for each elevator model.

Disregarding dryer operating costs due to volume and management, which would not be influenced by size of elevator, the additional fixed expenses alone would make the equivalent of 80,000 additional bushels necessary at 5 cents per bushel merchandising or handling costs. Of course, in the usual operations, purchase discounts for wet grain would result in wider gross margins which could absorb higher per bushel costs without the additional volume. Figure 13 and Table 40 show the additional volume necessary to remain at a 4 cent, 5 cent, and 6 cent per bushel grain merchandising or handling cost level when $2,900 of fixed costs was added for each of the new concrete elevator models. They also show the change in volume needed to cover the additional costs as the volume and the unit cost level change.

As volume increased per bushel, fixed costs decreased in relation to per bushel variable costs. Therefore, as volume increased or as total unit cost decreased, it took more bushels of additional volume to cover a given increase in the amount of fixed costs. Thus, it took only 60,000 bushels at 6 cents, then 80,000 bushels at 5 cents, and up to 120,000 bushels at 4 cents per bushel.

FIGURE 13

RELATION OF COST TO VOLUME OF GRAIN MERCHANDIZED OR HANDLED BY NEW ELEVATOR WITH AND WITHOUT GRAIN DRYER

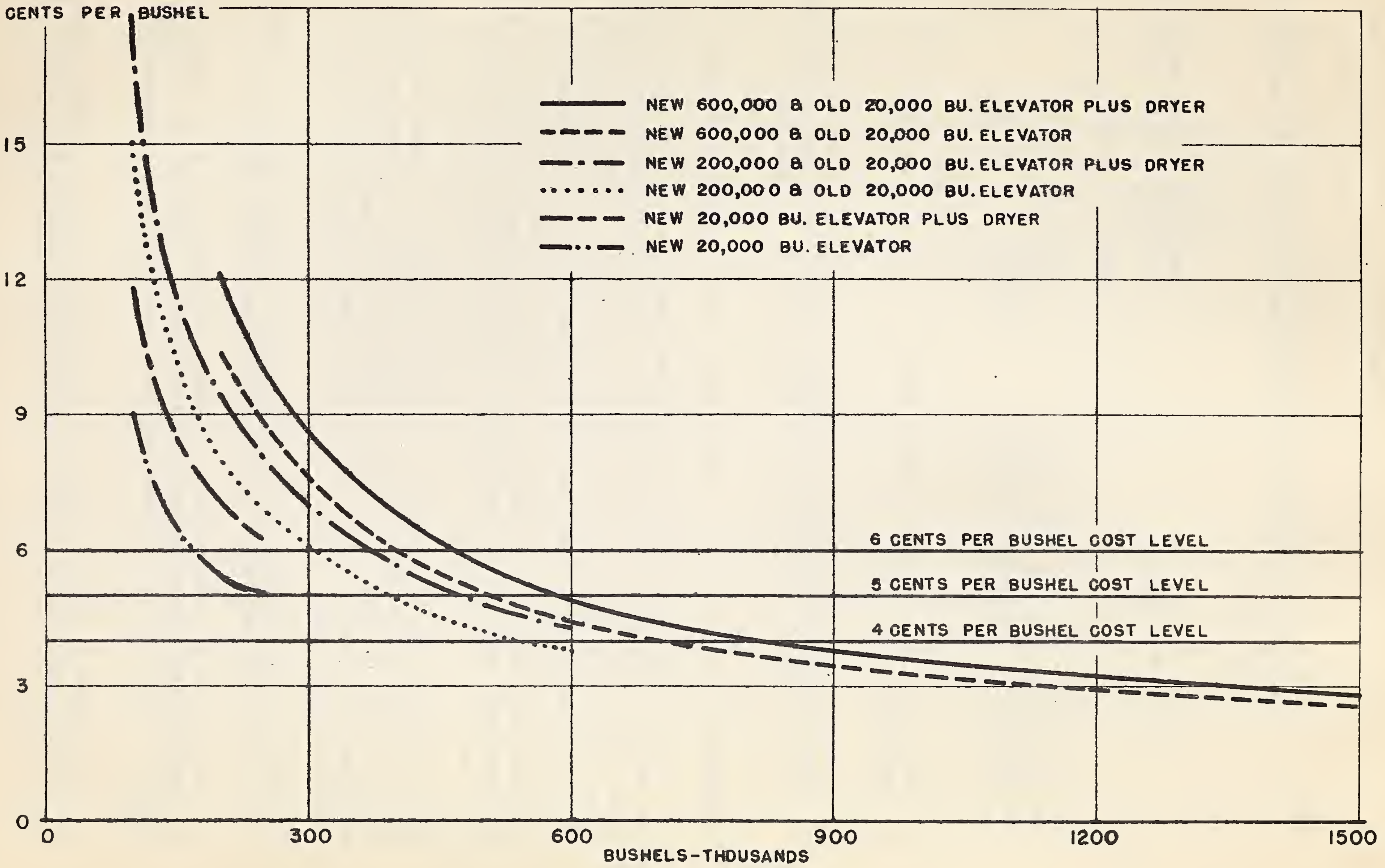


Table 40 - Volume -- Total unit cost relations when fixed expenses are increased $2,900 by installation of additional equipment for merchandising or handling. 1/

Elevator models	Increased volume necessary when unit costs are: 2/		
	4 cents	5 cents	6 cents
New 100,000-bu. plus old 20,000-bu.	-	80,000	60,000
New 200,000-bu. plus old 20,000-bu.	120,000	80,000	60,000
New 300,000-bu. plus old 20,000-bu.	120,000	80,000	60,000
New 600,000-bu. plus old 20,000-bu.	140,000	80,000	60,000

1/ This is from the fixed expenses shown for each of the model elevators, Table 34.

2/ This is the additional annual volume necessary to allow the $2,900 additional fixed expense on equipment to operate with the same total unit costs as those at which the standard equipment shown in Table 1 operates.

Building and Equipment Costs Increasing or Decreasing by 20 Percent

The building and equipment valuations used in the elevator models were about the average of current construction and installed equipment costs in the areas where hard winter wheat is the principle cash crop. Obviously, when building an elevator at a specific location at some future date, the valuations at that time may be different from those used in the study models. Therefore, it is important to know how costs will respond to a different set of new elevator valuations. To indicate that response, valuations for both the elevator building and installed equipment are shown at 20 percent above and also at 20 percent below the valuations used in the preceding study models for the two grain functions.

Grain merchandising or handling - - Figure 14 shows the total cost curves at plant and equipment valuations 20 percent above and also at 20 percent below total costs based on current valuations shown in Figure 6. If current valuations were shown on Figure 13, the line would fall roughly midway between the high and the low valuation lines shown.

Only 3 of the 6 elevator models are used in Figure 13 to illustrate the new total cost lines resulting from substantial valuation changes.

Table 41 shows the changes in bushel volume due to the 20 percent higher, or 20 percent lower, plant and equipment valuation, necessary to maintain 3 different levels of total unit costs based on the current variable costs used in the study models.

Differences in volume due to the various per unit cost levels were explained in the discussion dealing with increasing fixed expenses by a given amount. (Page 100.)

FIGURE 14

RELATION OF COST TO VOLUME OF GRAIN MERCHANDIZED OR HANDLED BY NEW ELEVATOR VALUED AT 20% LOWER AND HIGHER THAN STUDY EXAMPLES

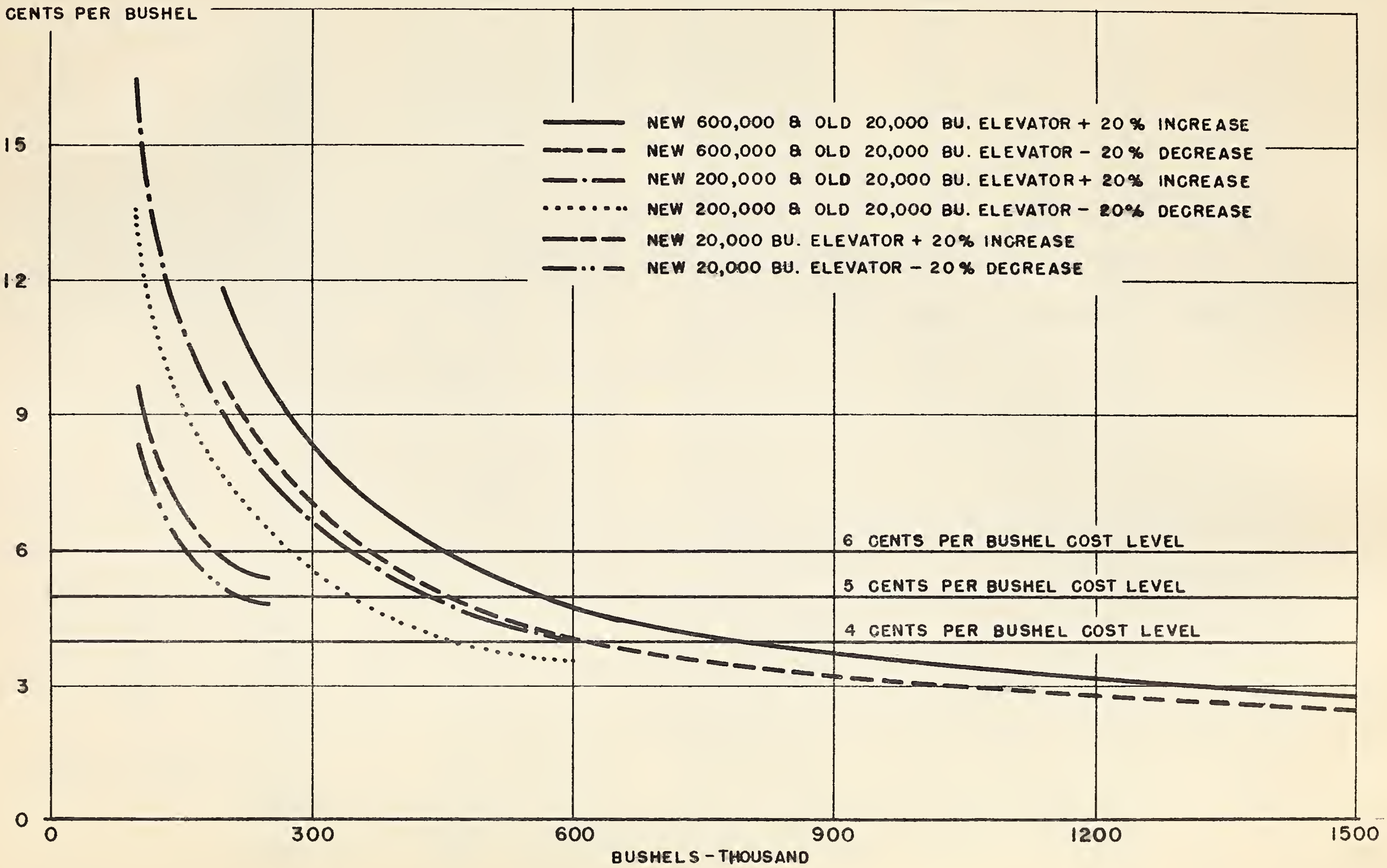
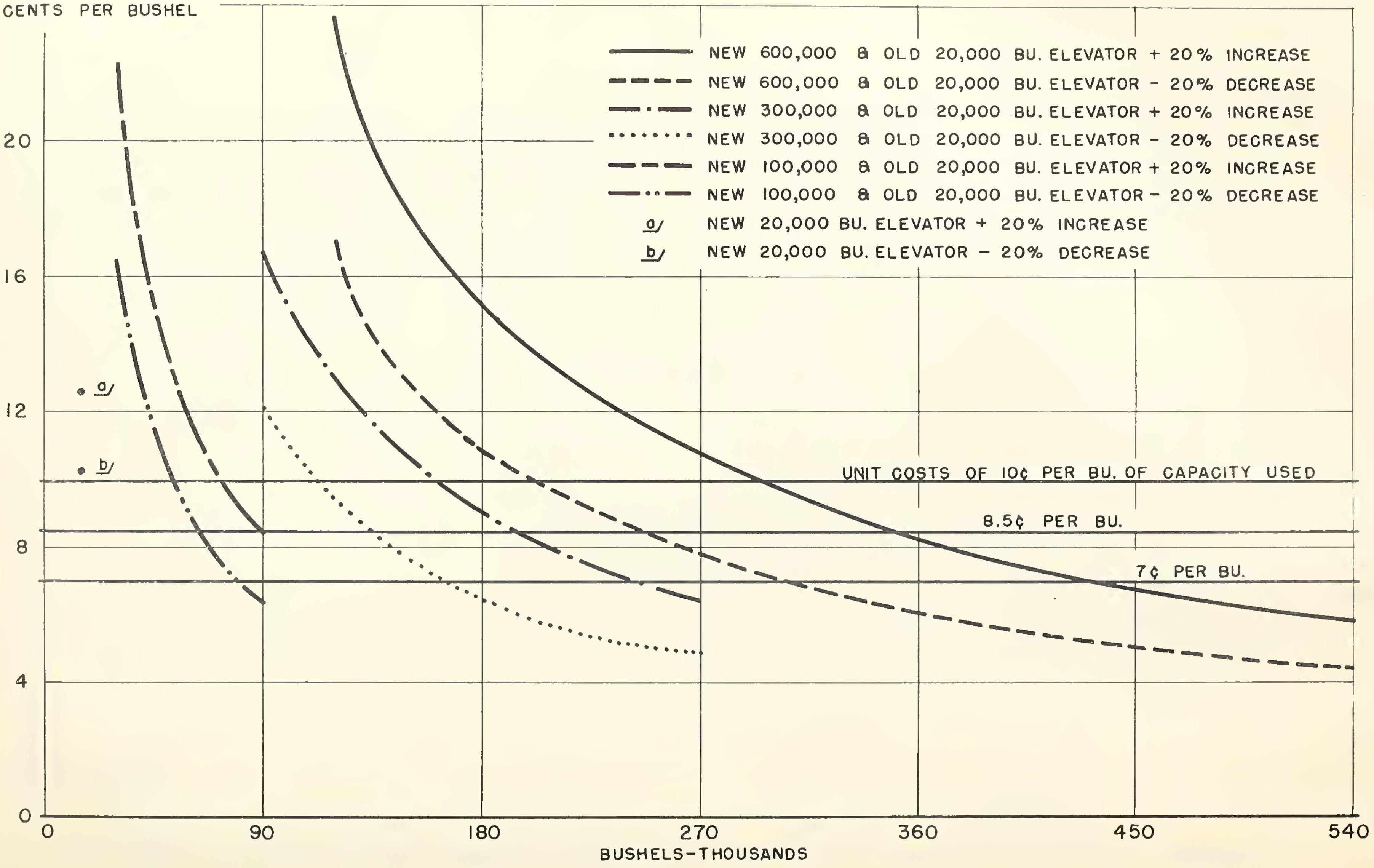


FIGURE 15

RELATION OF COST TO VOLUME OF GRAIN STORED BY NEW ELEVATOR VALUED AT BOTH 20% LOWER AND 20% HIGHER THAN STUDY EXAMPLES



However, in the models shown in Figures 14 and Table 41, the amount of expense was different for each of the elevator models because it was based on a percentage change of current valuations that varied with size of facility. Therefore, Table 41 shows more bushels required for a given unit cost level in the larger elevators because the amount of the fixed expense was larger.

Storage -- Figure 15 shows the same general type of relationship between volume and total unit cost changes due to changes in valuation as just discussed for the grain merchandising or handling function.

The specific differences in total costs shown in Figure 14 from those shown in Figure 13 were due almost entirely to the much higher ratio in the storage function of fixed costs to costs due to volume and management decisions.

Table 42 shows data for the storage function comparable to Table 41 for the grain merchandising or handling function.

INFLUENCE OF THE SIDELINE FUNCTION

This study does not deal with the sideline function except as it influences costs of the two grain functions in the operations of the elevator models used. From that standpoint sideline operations at $145,000 volume, as compared to $30,000, reduced grain merchandising or handling costs by $535, regardless of grain volume. Grain storage costs were practically identical for both sideline volume situations used in the models regardless of the amount of elevator capacity used for storage.

In considering the relation of the sideline operations to the two grain functions, it should be recalled that the caliber of management assumed in the models was good. Also sideline facilities were conveniently located with respect to both the office and elevators to allow for good use of those personnel working at both the sideline and grain functions. It should also be recalled that all costs were allocated to the primary grain function except those due directly to one of the secondary functions. Or, for costs divided between the primary and a secondary function that portion going to the primary function was the same amount that would have been necessary to operate that function independently.

Unit Costs

Expenses allocated to the $30,000 sideline model were $2,789 or approximately 9 cents per dollar of sales. When petroleum products were added to increase volume to $145,000 annually, expenses allocated to this function were $15,919 or about 11 cents per dollar of sales.

Table 41 - Grain merchandising or handling volume response at specified per bushel cost levels — valuations on both new elevator building and equipment in new elevators that are 20 percent higher and 20 percent lower than those used in the study models.

New elevator models	Volume necessary at 4 cents per bu. cost			Volume necessary at 5 cents per bu. cost			Volume necessary at 6 cents per bu. cost		
		Change when valuations were:			Change when valuations were:			Change when valuations were:	
	Current valuations	20 percent higher	20 percent lower	Current valuations	20 percent higher	20 percent lower	Current valuations	20 percent higher	20 percent lower
				(In thousands of bushels)					
New 100,000-bu. plus old 20,000-bu.	1/	1/	1/	350	+ 35	— 30	275	+ 30	— 25
New 200,000-bu. plus old 20,000-bu.	550	+ 60	- 50	395	+ 45	- 40	310	+ 35	— 30
New 300,000-bu. plus old 20,000-bu.	600	+ 80	— 65	435	+ 50	— 45	340	+ 40	— 35
New 600,000-bu. plus old 20,000-bu.	700	+115	— 85	510	+ 60	— 55	405	+ 45	— 40

1/ Volumes necessary were above those generally considered practical for this size elevator.

Note - The two different levels of sideline volume were not a factor influencing the above data.

Table 42 - Relationships between storage capacity used in the elevator models under three situations of facility and equipment costs when —

(A) Average cost per bushel of capacity used is 10 cents per bushel:

Elevator models	Current building costs 1/		New elev. costs 20 percent higher than current		New elev. costs 20 percent lower than current	
	Capacity used	Change2/	Capacity used	Increase3/	Capacity used	Decrease3/
	(in thousands of bushels of capacity used)					
New 100,000-bu. plus old 20,000-bu.	62	—	71	+ 13	53	- 9
New 200,000-bu. plus old 20,000-bu.	98	+ 36	117	+ 19	83	- 15
New 300,000-bu. plus old 20,000-bu.	137	+ 39	161	+ 24	113	- 24
New 600,000-bu. plus old 20,000-bu.	240	+ 108	287	+ 47	195	- 45
(B) Average storage cost per bushel of capacity used is 8.5 cents per bushel:						
New 100,000-bu. plus old 20,000-bu.	76	—	87	+ 11	63	- 13
New 200,000-bu. plus old 20,000-bu.	120	+ 48	141	+ 21	100	- 19
New 300,000-bu. plus old 20,000-bu.	165	+ 45	193	+ 28	138	- 27
New 600,000-bu. plus old 20,000-bu.	292	+ 127	347	+ 55	235	- 47
(C) Average storage cost per bushel of capacity used is 7.0 cents per bushel:						
New 100,000-bu. plus old 20,000-bu.	94	—	Can't store enough		80	- 14
New 200,000-bu. plus old 20,000-bu.	150	+ 58	177	+ 28	126	- 24
New 300,000-bu. plus old 20,000-bu.	206	+ 56	242	+ 36	172	- 34
New 600,000-bu. plus old 20,000-bu.	365	+ 158	428	+ 63	303	- 62

1/ Current building and equipment costs refer to those used for the principal study models shown in Table 1.

2/ This is the increase in use of capacity in the next larger size plant necessary to have equal costs at the cost level used.

3/ This is the change in capacity used from current amounts (Column 1) necessary to have equal costs at the level used in the same elevator model.

Note - The two different levels of sideline volume were not a factor influencing the above data.

Complimentary Relations

No attempt was made to measure the exact extent to which sideline operation in either model volume situation was responsible for increased grain volume and therefore was complimentary to the primary grain function. From observations made during this study and others, the authors know that sideline operations may be an influence for more grain merchandising or handling volume to the extent that they are responsible for improved patron relations. It is believed that with the level of management and patron relations used in the model operations, sideline operations will be responsible for an increase of about 5 percent in grain volume for the primary function.

However, there are managements where the sideline function is handled in such a way as to be a factor in decreasing grain volume. For example, where management's credit policy is lax and accounts receivable are allowed to get old and large, some patrons may take their grain business elsewhere to avoid paying their sideline account receivable or because that management policy is an indication to them of general inefficiency of management.

Therefore, in actual elevator operation the extent to which sideline operations compliment the primary grain function depends on management and personnel policy and practice as they affect patron relations in comparison with an independent operation of the grain functions.

Supplementary Relations

Where sideline volume in the models was $145,000 annually, efficiency of the grain merchandising or handling function was increased by $535 as compared to comparable grain operation models with $30,000 of sideline volume. No difference was evident for the grain storage function.

The gross supplementary influence of sideline operations in elevators was reduced because salary scales were slightly higher for the higher sideline volume models. Manager's salary was a little higher as was the salary of the first elevator man working at both the elevator and at the sideline warehouse. Therefore, the net amount of total personnel expense charged to the primary function was substantially less than the gross influence. The part of the net supplemental value accrued from less idle personnel time charged to the grain function - $515 of the total of $535 - was less than half the difference in personnel expense charged to sidelines when sideline volume was $145,000 rather than $30,000.

The savings from the supplementary action of sideline operations for the primary grain function meant more per unit in the smaller and lower-volume elevators. For example, the $535 meant a saving of a little over one-half cent a bushel when grain volume was only 100,000 bushels. But in the large elevator operations with volume of a million bushels, the saving per bushel was only about five one-hundredths of a cent compared to the small sideline models.

The layout of the elevators, the warehouse, and the office has an important influence on the extent to which personnel can work back and forth at all three facility locations. If sideline and grain facilities are so located as to make it impractical for the elevator employees to help at the feed and farm supply warehouse, the supplemental action of sideline operations will be reduced or eliminated entirely.

Management policy is also an important influence on the supplementary action of the sideline function. It is easy for management to take on the extra help needed for seasonally high grain receipts and shipments and to continue them on as full-time sideline employees. Ordinarily the first elevator man could handle the feed and farm supply warehouse activities used in operating the elevator models most of the year. Such a situation would eliminate entirely the supplementary influence of the sideline function on the primary grain function.

Therefore, the sideline function may be a means of using more efficiently, personnel necessary for the grain function, as is illustrated in the model operations. But, it does require an entire plant layout which makes it convenient for personnel to work at more than one functional facility. And it requires management that gives careful attention to the supplementary use of personnel time.

CONCLUSIONS

The study procedure used whereby cost items were budgeted to operations of elevator models, is believed to be more accurate than other analysis methods used more often in the past. This study procedure results in the following conclusions regarding the problem of deciding on capacity of new elevator and equipment for a given location in the hard winter Wheat Belt:

1. The most important single step in planning for new elevator and equipment is the appraisal of volume to be merchandised or handled during the life expectancy of the new elevator. For factors to be considered in making that appraisal see Where and How Much Cash Grain Storage for North Dakota Farmers, Farm Credit Administration Bulletin No. 61, April 1951, p. 27-51 (now distributed by the Farmer Cooperative Service).

2. After making as realistic an appraisal of potential volume as possible, it is less costly to be on the conservative side when selecting elevator storage capacity. Provision, however, should be made at the time of building for adding storage capacity at a later date when the need may be greater or more evident in terms of specific volume. The cost at that time is negligible compared to the advantages if later operating experience proves the need for additional storage capacity.

3. It is better to be on the liberal side in appraising volume in selecting elevator receiving and loading out equipment capacity. Once the elevator is built, alterations that may be needed to increase equipment handling capacity or shipping capacity can be quite expensive. Also, it is not usually so convenient to make provision for increasing equipment handling or shipping capacity after the elevator is built.

4. When expected annual volume is large enough to allow merchandising or handling operations near the maximum practical volume level for the two largest elevator model sizes, these elevators have a distinct advantage in competing with the smaller elevators. They can merchandise or handle grain at lower per bushel costs and they can compete under a wider volume range resulting from variation in crop production (Table 33).

5. Local elevator capacity built for storing wheat for the farmers' accounts should not exceed what is considered an average or normal excess above the quantities that can be shipped to terminal storage during the harvest season. The greater turnover in relation to capacity decreases the per bushel costs of the merchandising or handling functions.

6. The larger elevator models also have an advantage over the smaller sizes on storage costs when volume stored is sufficient to use about all available storage capacity (Table 34). As has been pointed out for grain merchandising or handling, they can compete successfully with smaller elevators when variations in crop production cause various amounts of storage to be used.

7. A guide for deciding on the economy of making a change in a standard new elevator design is as follows: The expense of all fixed costs on valuations resulting from the change must be less than the decreases expected on such so-called variable expense items as labor, power, maintenance, repairs, insurance, and so on. The calculation is made as follows: Add the rates of depreciation, interest, taxes, and insurance applicable to the elevator building valuations. Divide the total of these rates into 100. The result is the dollar amount of investment that will result annually in a dollar of fixed expense. Obviously if a change is made in design that results in fixed expenses being less than the savings in variable expense items, then an additional investment for a design change lowers total cost. Conversely, if a design change that lowers investment, and therefore fixed expense, is made, the amount of lower fixed expense must not be offset by higher costs of labor, power, repairs, maintenance, insurance, and so on. That may result from decreasing the investment in design.

8. The same calculation can be used in making a decision on investment in elevator equipment. Equipment rates of depreciation are higher, therefore the ratio of dollar investment to saving in variable expenses is lower. (Table 36).

9. Both elevator design and equipment changes should be considered from the viewpoint of their influence on annual volume and service to farmers as well as their influence on unit costs as calculated in items 7 and 8 preceding.

10. At a given location variable expenses do not change significantly at comparable annual volumes because of size of elevators when annual volume is 400,000 bushels or more. Therefore, management need only consider the influence of fixed costs from elevator and equipment valuations when estimating operating costs for the different size of new elevators they may have under consideration.

11. Variable expenses also contribute to economy of scale but not nearly as much as fixed expenses. Variable per bushel costs decrease about 1-1/2 cents in changing from an annual volume of 300,000 bushels to 15 million bushels. On down in the lower range variable expenses show quicker savings in relation to scale; they are more nearly like fixed expenses in that range on the scale. Variable expense accounted for an economy of 2-1/2 cents per bushel of economy in the range between 100,000 bushels and 300,000 bushels annually. (Figure 8).

12. Often a decision must be made to keep and use or to tear down the old elevator after a new one is built. In the study models used, the old elevator adds a minimum of $1,217 and $217 to the respective annual grain merchandising or handling and grain storage costs. At a 5 cent-per-bushel cost of merchandising or handling grain, an additional 30,000 bushels annual volume is necessary to justify the additional $1,217 of costs of operating the old elevator in conjunction with the new facility. At lower per bushel cost levels, the additional volume necessary will be higher. Costs of keeping the old elevator will increase from the amounts shown by the same amount that additional personnel expense may be necessary when operating the old with the new elevator.

13. As expensive grain equipment is added or as new building and equipment costs advance sharply and result in higher fixed costs, these latter costs constitute a larger part of total costs. Therefore, although total costs are higher on a per-bushel basis they decrease at a faster rate on the volume scale. Thus under these situations volume becomes even more important as an economy of scale factor. (Tables 13 to 15).

14. Sideline operations as a secondary elevator function may be both complimentary and supplementary to the primary function of grain merchandising or handling. But better than average management is necessary, as is good overall plant arrangement, for the use of the same personnel for both the sideline and the grain functions. With less than good management or plant arrangement, sideline operations are not likely to contribute to grain volume or to lower grain marketing costs. They may even have the reverse effect on the grain functions.